JAPANESE [JP,2002-369239,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] It is the communication system with which each of two or more of said networks consists of communication devices connected with two or more radio equipment and said two or more radio equipment by consisting of two or more networks. Which base station in the 1st network among said two or more networks The means which will rewrite the path information registered beforehand if the terminal from the 2nd network is detected, Have a means to transmit the detection information on said terminal to addressing to a communication device in said 1st network, and said communication device in said 1st network the communication system characterized by having the means which rewrites the path information beforehand registered based on the detection information on said terminal, and a means for the communication device in networks other than said 1st network to boil the detection information on said terminal, respectively, and to transmit.
[Claim 2] Each of the communication device in networks other than the 1st [said] network which received the detection information on said terminal is communication system according to claim 1 characterized by rewriting the path information beforehand registered based on the detection information on said terminal.
[Claim 3] If the terminal from the wireless area of the 2nd radio equipment in said 1st network is detected, the 1st radio equipment in said 1st network It has the means which rewrites the path information registered beforehand, and a means to transmit the detection information on said terminal to radio equipment other than said 1st radio equipment in said 1st network. Each of said radio equipment other than said 1st radio equipment is communication system according to claim 1 characterized by having the means which rewrites the path information registered beforehand, when the detection information on said terminal is received.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the communication system between road and car which realizes an intelligent transport system (ITS;Intelligent Transport Systems).
[0002]
[Description of the Prior Art] In order to realize service which aimed at improvement in safety, improvement in transportation efficiency, and improvement in the amenity in recent years, development of the intelligent transport system which used the road and the car as the system of one is furthered.
[0003] As one field of the intelligent transport system, he is a corporation. The electronic toll collection system (ETC:Electric Toll Collection System) given in the standard "the 551.2nd edition of turnpike electronic toll collection system standard ARIBSTD-T" (December 14, Heisei 11 1.2 amendment) defined in Association of Radio Industries and Businesses is known. An electronic toll collection system is a system between highway and vehicle which performs radio called dedicated short range communications (DSRC:Dedicated Short Range Communication) between the mounted terminal (mounted equipment) carried in the car, and the road-side equipment installed in the tollgate, and carries out automatic **** of the toll in the tollgate of a turnpike, without the car which passes through a tollgate stopping.
[0004] On the other hand, there is a request that he wants to apply IP (Internet Protocol) communication technology to an intelligent transport system, and to realize various communication service (IP packet communication), such as voice, data, and an image, with the explosive spread of the Internet in recent years. In this case, even if the terminal carried in the car moves, the technique (hand-over) which enables communicative continuation is needed.
[0005] As a technique of realizing hand-over, a regular mobile (Mobile) IP technique is in "RFC (Request For Comment: document which tells the information about the Internet)2002", for example. This technique is developed supposing the case where a terminal is mainly used, moving temporarily from the location currently originally used. The node by which a terminal is called a home agent (HA:Home Agent) to the network (home network: Home Network) to which it belongs usually is made to intervene. Moreover, the node called a foreign agent (FA:Foreign Agent) to the network (foreign network: Foreign Network) of a migration place is made to intervene. Once transmitting to a home agent, a transfer of a packet when a terminal moves to a foreign network from a home network is transmitted to foreign EJANTO, and is transmitted to a terminal.
[0006]
[Problem(s) to be Solved by the Invention] Since the electric wave of a microwave band is being used for above-mentioned dedicated short range communications, its range (wireless zone) which can radiocommunicate is as small as 30m, and they do not have the lap range of wireless zones, either. Therefore, in order for a car to continue and to enable IP communication link, without breaking off even if it moves such two or more wireless zones to a high speed, it is necessary to realize hand-over for a short time. Moreover, the packet from IP network once concentrates the above-mentioned mobile IP technique on a home agent. Therefore, when a mobile IP technique is applied to the system between highway and vehicle which very many cars

move to a high speed, the fall of a home agent's throughput, as a result decline in a network utilization ratio will be caused.
[0007] The purpose of this invention is in view of the above point to offer the communication system which can realize hand-over in a short time.
[0008] Other purposes of this invention are to offer the communication system which can realize hand-over, without reducing a network utilization ratio.
[0009]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the communication system of this invention It is the communication system with which each of two or more of said subnets consists of the gateways connected with two or more base stations and said two or more base stations by consisting of two or more subnets. Which base station in the 1st subnet among said two or more subnets The means which will rewrite the path information registered beforehand if the terminal from the 2nd subnet is detected, Have a means to transmit the detection information on said terminal to addressing to the gateway in said 1st subnet, and said gateway in said 1st subnet It has the means which rewrites the path information beforehand registered based on the detection information on said terminal, and a means to transmit the detection information on said terminal to each of the gateway in subnets other than said 1st subnet. Each of the gateway in subnets other than the 1st [said] subnet which received the detection information on said terminal has the means which rewrites the path information beforehand registered based on the detection information on said terminal.
[0010] Moreover, the 1st base station in said 1st subnet If the terminal from the wireless area of the 2nd base station in said 1st subnet is detected It has the means which rewrites the path information registered beforehand, and a means to transmit the detection information on said terminal to base stations other than said 1st base station in said 1st subnet. Each of said base stations other than said 1st base station has the means which rewrites the path information registered beforehand, when the detection information on said terminal is received.
[0011]
[Embodiment of the Invention] Hereafter, the operation gestalt of the communication system by this invention is explained to a detail with reference to a drawing.
[0012] Drawing 1 is drawing showing the configuration of the whole communication system of this invention.
[0013] The communication system of this invention consists of the network 110 (a subnet 110 is called hereafter), a subnet 111, a subnet 112, and an IP network (for example, mobile IP network) 120 that IP communication link should be made possible in a system between highway and vehicle. The subnet 110 consists of the gateways (communication device) 130 connected with the communication network 150 connected with two or more base stations (radio equipment) 140-1 installed in the road side of a road - 140-n, and a base station 140-1 - 140-n, and the communication network 150. In addition, among drawing, 101-1 - 101-n show the wireless zone of a base station 140-1 - 140-n, respectively, and are. Moreover, the identification address (for example, AA.AA.AA.AA) for identifying the mounted terminal 104 is given to the mounted terminal 104 carried in the vehicle 100. The subnet 111 and the subnet 112 also have the same composition as a subnet 110.
[0014] Moreover, the gateways 130-132 are connected with the IP network 220 in this invention. Furthermore, in this invention, the gateways 130-132 interconnect with the gateway connection network 221, respectively. Moreover, in this invention, each of the gateways 130-132 has managed the destination information on each base station which a subordinate has. The gateways 130-132 carry out the multiple address transfer of the packet from the IP network 220 at each addressing to a base station of a subordinate, respectively.
[0015] Although a detail is mentioned later, the base station 140-1 by this invention - 140-n have managed the path information on the mounted terminal in a subordinate, respectively. When a mounted terminal moves into the same subnet between base stations, a migration place base station detects a terminal and the identification address of the terminal, and rewrites the contents of the path information on the mounted terminal registered beforehand. Moreover, a migration place base station notifies the purport that the mounted terminal was detected to

addressing to a base station of the others which belong in the same subnet. Other base stations which received the notice of terminal detection rewrite the contents of the path information on a mounted terminal based on the contents. By the above actuation, the packet from the IP network 120 is transmitted to the mounted terminal of a migration place.
[0016] Moreover, each of the gateways 130-132 has managed the information (for example, identification address) and path information on a mounted terminal belonging to a subnet. When a mounted terminal moves between subnets, the base station belonging to a migration place subnet rewrites the path information beforehand registered like the above. Moreover, the above-mentioned base station notifies the identification address of a mounted terminal to the gateway and other base stations in the same subnet. The gateway which received the notice rewrites the contents of terminal information and path information, and notifies the purport that the mounted terminal was detected to the gateway belonging to other subnets. Moreover, the base station which received the notice rewrites the contents of path information. The contents of the above-mentioned information into which the gateway belonging to other subnets and a base station are registered beforehand similarly are rewritten. By the above actuation, the packet from the IP network 120 is transmitted to the mounted terminal of a migration place.
[0017] Drawing 2 is the block diagram showing the configuration of the gateway 130 of this invention. The gateway 131 and the gateway 132 also have the same composition as the gateway 130.
[0018] The gateway 130 consists of IP network interface 200-1, the base station interface 200-2, the gateway connection network interface 200-3, the routing section 201, the message-processing section 202, and a control section 203. Furthermore, a control section 203 is equipped with a processor 220, the program storing memory 221, the identification address managed table 222, and routing table 223, and controls the gateway 130 whole in generalization.
[0019] Here, the gateway connection network interface 200-3 transmits the packet 211 which received from the gateway 131 or the gateway 132 to the routing section 201. Messages, such as terminal detection information for rewriting the contents (terminal information) of the identification address managed table 222 and the contents (path information) of routing table 223, are contained in the above-mentioned packet 211. The routing section 201 transmits the packet 211 which received from the gateway connection network interface 200-3 to the message-processing section 202. The message-processing section 202 assembles the packet 211 which received from the routing section 201 in a message 212, and transmits to a control section 203. The processor 220 with which a control section 203 is equipped analyzes the contents of the message, and rewrites the contents of the identification address managed table 222 and routing table 223.
[0020] Moreover, the above-mentioned message-processing section 202 assembles the message 212 which received from the control section 203 to a packet 211, and transmits to the routing section 201. The routing section 201 transmits the packet 211 which received from the message-processing section 202 to the gateway connection network interface 200-3. The gateway connection network interface 200-3 transmits the packet 211 which received from the routing section 201 to the gateway connection network 121.
[0021] Next, the packet 210 which received from the IP network 220 is transmitted to the routing section 201 through IP network interface 200-1. The routing section 201 exchanges for the base station interface 200-2 the packet 210 which received from IP network interface 200-1 based on routing table 223 (switching). The base station interface 200-2 carries out the multiple address transfer of the packet 210 which received from the routing section 201 at a base station 140-1 - addressing to 140-n. Similarly, the packet from a base station 140-1 - 140-n is transmitted to the IP network 220 through the base station interface 200-2, the routing section 201, and IP network interface 200-1.
[0022] In addition, the base station interface 200-1 mentioned above may be established for every base station. Moreover, it may be made to perform processing of the message-processing section 202 mentioned above by the control section 203.
[0023] Drawing 3 is the block diagram showing the configuration of the base station 140-1 of this invention. A base station 140-2 - 24-n also have the same composition as a base station 140-1.

[0024] The base station 140-1 consists of the gateway, the base station interface 300-1, a terminal interface 300-2, the routing section 301, the message-processing section 302, and a control section 303. Furthermore, a control section 303 is equipped with a processor 320, the program storing memory 321, and routing table 322, and controls the 140 to base station 1 whole in generalization.
[0025] In addition, since the actuation in each part of the routing section 301, the message-processing section 302, and a control section 303 is the same as that of the routing section 201 shown in drawing 2 R> 2, the message-processing section 202, and a control section 203, detailed explanation is omitted here.
[0026] The packet 211 containing a message is transmitted to a control section 303 through the gateway, the base station interface 300-1, the routing section 301, and the message-processing section 302. Similarly, the packet containing the message from a control section 303 is transmitted to the gateway and the base station interface 300-1 through the message-processing section 302 and the routing section 301.
[0027] Moreover, the packet 210 from the IP network 220 is transmitted to a terminal interface 300-2 through the gateway, the base station interface 300-1, and the routing section 301. A terminal interface 300-2 transmits the packet 210 which received from the routing section 301 to a mounted terminal. Similarly, the packet 210 from a mounted terminal is transmitted to the gateway and the base station interface 300-1 through a terminal interface 300-2 and the routing section 301.
[0028] Drawing 4 is drawing showing the configuration of the identification address managed table 322 with which the gateway of this invention is equipped.
[0029] An identification address 400, an operating condition 401, an affiliation subnet 402, and each area of an expiration date 403 are consisted of by the identification address managed table 222. The identification address in use or the identification address which can be given to a mounted terminal is stored in the identification address 400. The information showing whether each identification address stored in the area of an identification address 400 is used for the mounted terminal is stored in the operating condition 401. When the identification address is used for the mounted terminal by the affiliation subnet 402, the subnet name to which the mounted terminal belongs is stored in it. The expiration date of the identification address currently used for the mounted terminal is stored in the expiration date 403.
[0030] Drawing 5 is drawing showing the configuration of the routing table 223 with which the gateway of this invention is equipped.
[0031] It consists of each area of the output destination change 501 which shows the identification address 500 of a mounted terminal, and the output destination change of a packet in routing table 223.
[0032] Drawing 6 is drawing showing the configuration of the routing table 322 with which the base station of this invention is equipped.
[0033] An identification address 600, an output destination change 601 which shows the output destination change of a packet, and each area of the existence 602 of a base station subordinate are consisted of by routing table 322. The information showing whether the mounted terminal which has each identification address stored in the identification address 600 exists in the subordinate of the base station is stored in the existence 602 of a base station subordinate.
[0034] Drawing 7 is drawing showing an example of the description of this invention.
[0035] The example shown in drawing 7 shows the terminal detection message 212 used when a mounted terminal moves between the base station in the same subnet, or a subnet. The terminal detection message 212 consists of the detection terminal identification address 700 which stores the identification address of the detected mounted terminal, and each area of the message-sending former subnet name 701 which stores the subnet name by which the mounted terminal was detected.
[0036] In addition, although mentioned later, the message which it uses when the mounted terminal which has an identification address breaks away out of communication system (drawing 1) is called the identification address disconnection informative message 212. It is contained in

the message 212 as an identification address which the identification address of the mounted terminal should open wide. The grant of the identification address opened wide to other mounted terminals is attained.
[0037] Drawing 8 is the flow Fig. showing actuation of communication system when a mounted terminal goes into the subordinate of a subnet (for example, subnet 110) for the first time.
[0038] Detection of a new mount terminal of the processor 320 with which the control section 303 of a base station 140-1 is equipped requires the identification address which can be given to the new mount terminal of the gateway 130 (S801). (step S800)
[0039] The processor 220 with which the control section 203 of the gateway 130 is equipped will acquire an empty identification address (for example, AA.AA.AA.AA) with reference to the operating condition 401 of the identification address managed table 222, if a demand is received (S802). Next, a processor 220 notifies the acquired identification address to a base station 140-1 (S803).
[0040] "AA.AA.AA.AA" will be set as the identification address 600 of routing table 322, and the processor 320 with which the control section 303 of a base station 140-1 is equipped will set "**" as the existence 602 of "a terminal interface 300-2" and a base station subordinate in an output destination change 601, respectively, if a notice is received (S804, drawing 6).
[0041] Moreover, the processor 220 with which the control section 203 of the gateway 130 is equipped sets "under use" as the operating condition 401 of "AA.AA.AA.AA", and sets "a subnet 210" as the affiliation subnet 402, respectively. Furthermore, a processor 220 sets "AA.AA.AA.AA" as the identification address 500 of routing table 223, and sets "the base station interface 200-2" as an output destination change 501 (S805, drawing 4 R> 4, drawing 5). Next, a processor 220 generates the packet 211 containing the terminal detection message 212 (drawing 7), and transmits to a base station 140-2 - addressing to 140-n (S806).
[0042] "AA.AA.AA.AA" will be set as the identification address 600 of routing table 322, and the processor 320 with which the control section 303 of a base station 140-2 - 240-n is equipped will set "nothing" as the existence 602 of "a terminal interface 300-2" and a base station subordinate in an output destination change 601, if a notice is received (S807, drawing abbreviation).
[0043] Moreover, the processor 220 with which the control section 203 of the gateway 130 is equipped transmits the above-mentioned packet 211 also to the gateway 131 and addressing to 132 (S808). This packet 211 is transmitted to the gateways 131 and 132 through the gateway connection network 121.
[0044] The processor 220 with which the control section 203 of the gateways 131 and 132 is equipped searches the identification address 400 of the identification address managed table 222 based on the detection terminal identification address "AA.AA.AA.AA" (drawing 7) included in the terminal detection message 212. When there is an identification address "AA.AA.AA.AA" which is in agreement with an identification address 700, a processor 220 sets "under use" as an operating condition 401. Moreover, a processor 220 sets "a subnet 110" as the affiliation subnet 502 based on the message-sending former subnet name "a subnet 110" included in the terminal detection message 212 (S809, drawing 4). In addition, when the corresponding identification address does not exist, a processor 220 newly creates an entry after the entry of the identification address which can be given. Based on the terminal detection message 212, "AA.AA.AA.AA" is set as an identification address 400 and, as for it, a processor 220 sets "a subnet 110" as an operating condition 401 "during use" at the affiliation subnet 402.
[0045] Furthermore, the processor 220 with which the control section 203 of the gateway 130 is equipped notifies an identification address "AA.AA.AA.AA" to the IP network 120 (S810). By the above actuation, the packet addressed to the above-mentioned mounted terminal from the IP network 120 is transmitted to a mounted terminal through the gateway 130 and a base station 140-1.
[0046] Drawing 9 is the flow Fig. showing communication system actuation when a mounted terminal moves between the base stations in the same subnet (for example, subnet 110).
[0047] For example, when the mounted terminal 104 (identification address "AA.AA.AA.AA") moves to wireless zone 101-[of base station 140-n] n from the wireless zone 101-1 of a base

station 140-1, the terminal interface 300-2 with which base station 140-n is equipped detects the mounted terminal 104 (S900). Next, the processor 320 with which the control section 303 of base station 140-n is equipped analyzes the message 212 which received, and detects an identification address "AA.AA.AA.AA" (S901). Next, a processor 320 carries out the multiple address transfer of the packet 211 containing the terminal detection message 212 (drawing 7) which made "the subnet 110" "AA.AA.AA.AA" and a message-sending former subnet name for the identification address at the gateway 130, a base station 140-1 - 140- (n-1) (S902, S903). Moreover, a processor 320 rewrites the existence 602 of the base station subordinate of routing table 322 from "nothing" to "**" (S904, drawing 11 R> 1).

[0048] Next, the processor 320 with which the control section 303 of a base station 140-1 - 140- (n-1) is equipped analyzes the terminal detection message 212 which received. A processor 320 searches the identification address 600 of routing table 322 based on the detection terminal identification address "AA.AA.AA.AA" included in the terminal detection message 212. When a processor 320 has an identification address "AA.AA.AA.AA" and the existence 602 of a base station subordinate serves as "**", "nothing" is set as the existence 602 of a base station subordinate (S905). Here, the existence 602 of the base station subordinate of the routing table 322 with which a base station 140-1 is equipped writes and replaces "nothing" from "**" (drawing 11).

[0049] Moreover, the processor 220 with which the control section 203 of the gateway 130 is equipped analyzes the terminal detection message 212 which received. A processor 220 checks that the message-sending former subnet name 701 contained in the terminal detection message 212 is "a subnet 110", and discards the terminal detection message 212 (S906). By the above actuation, the packet from the IP network 120 comes (drawing 11) to be transmitted to the mounted terminal 104 of a migration place through base station 140-n.

[0050] Drawing 10 is the flow Fig. showing actuation of the communication system at the time of moving between the subnets from which a mounted terminal differs.

[0051] For example, when the mounted terminal 104 (identification address "AA.AA.AA.AA") moves to the wireless zone 141-1 of the base station 141-1 belonging to a subnet 111 from wireless zone 140-[of base station 140-n belonging to a subnet 110] n, the terminal interface 300-2 with which a base station 141-1 is equipped detects the mounted terminal 104 (1000). Next, the processor 320 with which the control section 303 of a base station 141-1 is equipped analyzes the message 212 which received, and detects an identification address "AA.AA.AA.AA" (S1001). Next, a processor 320 carries out the multiple address transfer of the packet 211 containing the terminal detection message 212 which made "the subnet 111" "AA.AA.AA.AA" and a message-sending former subnet name for the identification address at the gateway 131, a base station 141-2 - 141-n (S1002, S1003). Moreover, a processor 320 sets "AA.AA.AA.AA" as the identification address 600 of routing table 322, and sets "**" as "the base station interface 300-2" and the existence 602 of a base station subordinate in an output destination change 601 (S1004, drawing 12).

[0052] The processor 220 with which the control section 203 of the gateway 131 is equipped analyzes the terminal detection message 212 which received. A processor 220 rewrites the affiliation subnet 402 of the identification address managed table 222 from a subnet 110 to a subnet 111 based on the contents of the terminal detection message 212 (drawing 12). Moreover, although not illustrated, "AA.AA.AA.AA" is set as the identification address 500 of routing table 223, and "the base station interface 200-2" is set as an output destination change 501 (S1005).

[0053] The processor 320 with which the control section 303 of a base station 141-2 - 141-n is equipped analyzes the terminal detection message 212 which received. Although not illustrated, based on the contents of the terminal detection message 212, "AA.AA.AA.AA" is set as the identification address 600 of routing table 322, and a processor 320 sets "nothing" as the existence 602 of "a terminal interface 300-2" and a base station subordinate in an output destination change 601 (S1006).

[0054] Next, the processor 220 with which the control section 203 of the gateway 131 is equipped carries out the multiple address transfer of the packet 211 containing the terminal

detection message 212 which made "the subnet 111" "AA.AA.AA.AA" and a message-sending former subnet name for the identification address after processing of S1005 in the gateways 130 and 132 belonging to other subnets 110 and 112 (S1007).

[0055] Next, the processor 220 with which the control section 203 of the gateways 130 and 132 is equipped analyzes the terminal detection message 212 which received. A processor 220 rewrites the affiliation subnet 402 corresponding to "AA.AA.AA.AA" in the identification address 400 of the identification address managed table 222 from a subnet 110 to a subnet 111 based on the contents of the terminal detection message 212 (S1008, drawing 12). In addition, in the gateway 132, although not shown clearly, since a moved material subnet is a subnet 110, processing is ended. In routing table 223, as for the gateway 130 belonging to the moved material subnet 110, an identification address 500 deletes the area of "AA.AA.AA.AA." Next, the processor 220 with which the control section 203 of the gateway 130 is equipped carries out the multiple address transfer of the terminal detection message 212 which received at a base station 140-1 - 140-n (1009).

[0056] Although not illustrated, as for the processor 320 with which the control section 303 of a base station 140-1 - 140-n is equipped, an identification address 500 deletes the area of "AA.AA.AA.AA" (S1010, drawing 12). Furthermore, the processor 220 with which the control section 203 of the gateway 131 is equipped notifies an identification address "AA.AA.AA.AA" after processing of S1007 (S1011). By the above actuation, the packet from the IP network 120 comes (drawing 11) to be transmitted to the mounted terminal 104 of a migration place through a base station 141-1.

[0057] Drawing 12 is the flow Fig. showing actuation when the expiration date 403 of an identification address carries out a time-out (the value of an expiration date 403 is zero).

[0058] For example, the processor 220 with which the control section 203 of the gateway 130 is equipped executes an ICMP echo command towards the terminal in which the affiliation subnet 402 of the identification address managed table 222 has this identification address when an expiration date 403 carries out a time-out about the entry of "the gateway 130" (1300). A processor 220 judges the existence of the response from a terminal (1301). If there is a response from a terminal, a processor 220 will reset an expiration date 403 to a certain fixed value (1302), and will notify the renewal of an expiration date 403 to the gateways 131 and 232 belonging to other subnets 111 and 112 (1303). The processor 220 with which the control section 203 of the gateways 131 and 232 which received the notice is equipped resets the expiration date 403 of the corresponding identification address to a certain fixed value (1310). The processor 220 with which the control section 203 of the gateway 130 will be equipped if a terminal to a response cannot be found judges whether it is the identification address which self gave from the entry location of the identification address managed table 322 (1304). If it is the identification address which self gave, the processor 220 with which the control section 203 of the gateway 130 is equipped will set the operating condition 401 of the identification address managed table 222 as an opening (1305). Moreover, with the identification address which self gave, if there is nothing, the processor 220 with which the control section 203 of the gateway 130 is equipped will delete the entry of this identification address of the identification address managed table 322 (1306). Then, the processor 220 with which the control section 203 of the gateway 130 is equipped deletes an element with this identification address from routing table 223 (1307). Furthermore, the processor 220 with which the control section 203 of the gateway 130 is equipped makes the open identification address contained in the identification address disconnection informative message 212 the identification address of the terminal which did not answer, and it sends out to the base station 140-1 in the same subnet 110 - 140-n, and the gateways 131 and 232 belonging to other subnets 111 and 112 by the multiple address (1308). The processor 320 with which the control section 303 of the base station 140-1 - 140-n which received the identification address disconnection informative message 212 is equipped deletes an element with the identification address shown in the open identification address contained in the identification address disconnection informative message 212 from routing table 322 (1309). The processor 220 with which the control section 203 of the gateways 131 and 132 which received the identification address disconnection informative message 212 is equipped About the

identification address shown in an open identification address, from the entry location of the identification address managed table 222 If it is the identification address which judged whether it was the identification address which the gateway 130 gave, and the gateway 130 gave The operating condition 401 of the identification address managed table 222 is set as an opening, and if it is not the identification address which the gateway 130 gave, the entry of this identification address of the identification address managed table 222 will be deleted (1310). The entry about the terminal which moved out of the network by the above actuation is deleted.

[0059]

[Effect of the Invention] According to this invention, the communication system which can realize hand-over in a short time can be offered.

[0060] Moreover, according to this invention, the communication system which can realize hand-over can be offered, without reducing a network utilization ratio.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the communication system between road and car which realizes an intelligent transport system (ITS;Intelligent Transport Systems).

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PRIOR ART

[Description of the Prior Art] In order to realize service which aimed at improvement in safety, improvement in transportation efficiency, and improvement in the amenity in recent years, development of the intelligent transport system which used the road and the car as the system of one is furthered.
[0003] As one field of the intelligent transport system, he is a corporation. The electronic toll collection system (ETC:Electric Toll Collection System) given in the standard "the 551.2nd edition of turnpike electronic toll collection system standard ARIBSTD-T" (December 14, Heisei 11 1.2 amendment) defined in Association of Radio Industries and Businesses is known. An electronic toll collection system is a system between highway and vehicle which performs radio called dedicated short range communications (DSRC:Dedicated Short Range Communication) between the mounted terminal (mounted equipment) carried in the car, and the road-side equipment installed in the tollgate, and carries out automatic **** of the toll in the tollgate of a turnpike, without the car which passes through a tollgate stopping.
[0004] On the other hand, there is a request that he wants to apply IP (Internet Protocol) communication technology to an intelligent transport system, and to realize various communication service (IP packet communication), such as voice, data, and an image, with the explosive spread of the Internet in recent years. In this case, even if the terminal carried in the car moves, the technique (hand-over) which enables communicative continuation is needed.
[0005] As a technique of realizing hand-over, a regular mobile (Mobile) IP technique is in "RFC (Request For Comment: document which tells the information about the Internet)2002", for example. This technique is developed supposing the case where a terminal is mainly used, moving temporarily from the location currently originally used. The node by which a terminal is called a home agent (HA:Home Agent) to the network (home network: Home Network) to which it belongs usually is made to intervene. Moreover, the node called a foreign agent (FA:Foreign Agent) to the network (foreign network: Foreign Network) of a migration place is made to intervene. Once transmitting to a home agent, a transfer of a packet when a terminal moves to a foreign network from a home network is transmitted to foreign EJANTO, and is transmitted to a terminal.

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EFFECT OF THE INVENTION

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Since the electric wave of a microwave band is being used for above-mentioned dedicated short range communications, its range (wireless zone) which can radiocommunicate is as small as 30m, and they do not have the lap range of wireless zones, either. Therefore, in order for a car to continue and to enable IP communication link, without breaking off even if it moves such two or more wireless zones to a high speed, it is necessary to realize hand-over for a short time. Moreover, the packet from IP network once concentrates the above-mentioned mobile IP technique on a home agent. Therefore, when a mobile IP technique is applied to the system between highway and vehicle which very many cars move to a high speed, the fall of a home agent's throughput, as a result decline in a network utilization ratio will be caused.
[0007] The purpose of this invention is in view of the above point to offer the communication system which can realize hand-over in a short time.
[0008] Other purposes of this invention are to offer the communication system which can realize hand-over, without reducing a network utilization ratio.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the communication system of this invention It is the communication system with which each of two or more of said subnets consists of the gateways connected with two or more base stations and said two or more base stations by consisting of two or more subnets. Which base station in the 1st subnet among said two or more subnets The means which will rewrite the path information registered beforehand if the terminal from the 2nd subnet is detected, Have a means to transmit the detection information on said terminal to addressing to the gateway in said 1st subnet, and said gateway in said 1st subnet It has the means which rewrites the path information beforehand registered based on the detection information on said terminal, and a means to transmit the detection information on said terminal to each of the gateway in subnets other than said 1st subnet. Each of the gateway in subnets other than the 1st [said] subnet which received the detection information on said terminal has the means which rewrites the path information beforehand registered based on the detection information on said terminal.
[0010] Moreover, the 1st base station in said 1st subnet If the terminal from the wireless area of the 2nd base station in said 1st subnet is detected It has the means which rewrites the path information registered beforehand, and a means to transmit the detection information on said terminal to base stations other than said 1st base station in said 1st subnet. Each of said base stations other than said 1st base station has the means which rewrites the path information registered beforehand, when the detection information on said terminal is received.
[0011]
[Embodiment of the Invention] Hereafter, the operation gestalt of the communication system by this invention is explained to a detail with reference to a drawing.
[0012] Drawing 1 is drawing showing the configuration of the whole communication system of this invention.
[0013] The communication system of this invention consists of the network 110 (a subnet 110 is called hereafter), a subnet 111, a subnet 112, and an IP network (for example, mobile IP network) 120 that IP communication link should be made possible in a system between highway and vehicle. The subnet 110 consists of the gateways (communication device) 130 connected with the communication network 150 connected with two or more base stations (radio equipment) 140-1 installed in the road side of a road - 140-n, and a base station 140-1 - 140-n, and the communication network 150. In addition, among drawing, 101-1 - 101-n show the wireless zone of a base station 140-1 - 140-n, respectively, and are. Moreover, the identification address (for example, AA.AA.AA.AA) for identifying the mounted terminal 104 is given to the mounted terminal 104 carried in the vehicle 100. The subnet 111 and the subnet 112 also have the same composition as a subnet 110.
[0014] Moreover, the gateways 130-132 are connected with the IP network 220 in this invention. Furthermore, in this invention, the gateways 130-132 interconnect with the gateway connection network 221, respectively. Moreover, in this invention, each of the gateways 130-132 has managed the destination information on each base station which a subordinate has. The gateways 130-132 carry out the multiple address transfer of the packet from the IP network 220 at each addressing to a base station of a subordinate, respectively.

[0015] Although a detail is mentioned later, the base station 140-1 by this invention - 140-n have managed the path information on the mounted terminal in a subordinate, respectively. When a mounted terminal moves into the same subnet between base stations, a migration place base station detects a terminal and the identification address of the terminal, and rewrites the contents of the path information on the mounted terminal registered beforehand. Moreover, a migration place base station notifies the purport that the mounted terminal was detected to addressing to a base station of the others which belong in the same subnet. Other base stations which received the notice of terminal detection rewrite the contents of the path information on a mounted terminal based on the contents. By the above actuation, the packet from the IP network 120 is transmitted to the mounted terminal of a migration place.
[0016] Moreover, each of the gateways 130-132 has managed the information (for example, identification address) and path information on a mounted terminal belonging to a subnet. When a mounted terminal moves between subnets, the base station belonging to a migration place subnet rewrites the path information beforehand registered like the above. Moreover, the above-mentioned base station notifies the identification address of a mounted terminal to the gateway and other base stations in the same subnet. The gateway which received the notice rewrites the contents of terminal information and path information, and notifies the purport that the mounted terminal was detected to the gateway belonging to other subnets. Moreover, the base station which received the notice rewrites the contents of path information. The contents of the above-mentioned information into which the gateway belonging to other subnets and a base station are registered beforehand similarly are rewritten. By the above actuation, the packet from the IP network 120 is transmitted to the mounted terminal of a migration place.
[0017] Drawing 2 is the block diagram showing the configuration of the gateway 130 of this invention. The gateway 131 and the gateway 132 also have the same composition as the gateway 130.
[0018] The gateway 130 consists of IP network interface 200-1, the base station interface 200-2, the gateway connection network interface 200-3, the routing section 201, the message-processing section 202, and a control section 203. Furthermore, a control section 203 is equipped with a processor 220, the program storing memory 221, the identification address managed table 222, and routing table 223, and controls the gateway 130 whole in generalization.
[0019] Here, the gateway connection network interface 200-3 transmits the packet 211 which received from the gateway 131 or the gateway 132 to the routing section 201. Messages, such as terminal detection information for rewriting the contents (terminal information) of the identification address managed table 222 and the contents (path information) of routing table 223, are contained in the above-mentioned packet 211. The routing section 201 transmits the packet 211 which received from the gateway connection network interface 200-3 to the message-processing section 202. The message-processing section 202 assembles the packet 211 which received from the routing section 201 in a message 212, and transmits to a control section 203. The processor 220 with which a control section 203 is equipped analyzes the contents of the message, and rewrites the contents of the identification address managed table 222 and routing table 223.
[0020] Moreover, the above-mentioned message-processing section 202 assembles the message 212 which received from the control section 203 to a packet 211, and transmits to the routing section 201. The routing section 201 transmits the packet 211 which received from the message-processing section 202 to the gateway connection network interface 200-3. The gateway connection network interface 200-3 transmits the packet 211 which received from the routing section 201 to the gateway connection network 121.
[0021] Next, the packet 210 which received from the IP network 220 is transmitted to the routing section 201 through IP network interface 200-1. The routing section 201 exchanges for the base station interface 200-2 the packet 210 which received from IP network interface 200-1 based on routing table 223 (switching). The base station interface 200-2 carries out the multiple address transfer of the packet 210 which received from the routing section 201 at a base station 140-1 - addressing to 140-n. Similarly, the packet from a base station 140-1 - 140-n is transmitted to the IP network 220 through the base station interface 200-2, the routing section

201, and IP network interface 200-1.
[0022] In addition, the base station interface 200-1 mentioned above may be established for every base station. Moreover, it may be made to perform processing of the message-processing section 202 mentioned above by the control section 203.
[0023] Drawing 3 is the block diagram showing the configuration of the base station 140-1 of this invention. A base station 140-2 - 24-n also have the same composition as a base station 140-1.

[0024] The base station 140-1 consists of the gateway, the base station interface 300-1, a terminal interface 300-2, the routing section 301, the message-processing section 302, and a control section 303. Furthermore, a control section 303 is equipped with a processor 320, the program storing memory 321, and routing table 322, and controls the 140 to base station 1 whole in generalization.
[0025] In addition, since the actuation in each part of the routing section 301, the message-processing section 302, and a control section 303 is the same as that of the routing section 201 shown in drawing 2 R> 2, the message-processing section 202, and a control section 203, detailed explanation is omitted here.
[0026] The packet 211 containing a message is transmitted to a control section 303 through the gateway, the base station interface 300-1, the routing section 301, and the message-processing section 302. Similarly, the packet containing the message from a control section 303 is transmitted to the gateway and the base station interface 300-1 through the message-processing section 302 and the routing section 301.
[0027] Moreover, the packet 210 from the IP network 220 is transmitted to a terminal interface 300-2 through the gateway, the base station interface 300-1, and the routing section 301. A terminal interface 300-2 transmits the packet 210 which received from the routing section 301 to a mounted terminal. Similarly, the packet 210 from a mounted terminal is transmitted to the gateway and the base station interface 300-1 through a terminal interface 300-2 and the routing section 301.
[0028] Drawing 4 is drawing showing the configuration of the identification address managed table 322 with which the gateway of this invention is equipped.
[0029] An identification address 400, an operating condition 401, an affiliation subnet 402, and each area of an expiration date 403 are consisted of by the identification address managed table 222. The identification address in use or the identification address which can be given to a mounted terminal is stored in the identification address 400. The information showing whether each identification address stored in the area of an identification address 400 is used for the mounted terminal is stored in the operating condition 401. When the identification address is used for the mounted terminal by the affiliation subnet 402, the subnet name to which the mounted terminal belongs is stored in it. The expiration date of the identification address currently used for the mounted terminal is stored in the expiration date 403.
[0030] Drawing 5 is drawing showing the configuration of the routing table 223 with which the gateway of this invention is equipped.
[0031] It consists of each area of the output destination change 501 which shows the identification address 500 of a mounted terminal, and the output destination change of a packet in routing table 223.
[0032] Drawing 6 is drawing showing the configuration of the routing table 322 with which the base station of this invention is equipped.
[0033] An identification address 600, an output destination change 601 which shows the output destination change of a packet, and each area of the existence 602 of a base station subordinate are consisted of by routing table 322. The information showing whether the mounted terminal which has each identification address stored in the identification address 600 exists in the subordinate of the base station is stored in the existence 602 of a base station subordinate.
[0034] Drawing 7 is drawing showing an example of the description of this invention.
[0035] The example shown in drawing 7 shows the terminal detection message 212 used when a mounted terminal moves between the base station in the same subnet, or a subnet. The terminal detection message 212 consists of the detection terminal identification address 700 which

stores the identification address of the detected mounted terminal, and each area of the message-sending former subnet name 701 which stores the subnet name by which the mounted terminal was detected.
[0036] In addition, although mentioned later, the message which it uses when the mounted terminal which has an identification address breaks away out of communication system (drawing 1) is called the identification address disconnection informative message 212. It is contained in the message 212 as an identification address which the identification address of the mounted terminal should open wide. The grant of the identification address opened wide to other mounted terminals is attained.
[0037] Drawing 8 is the flow Fig. showing actuation of communication system when a mounted terminal goes into the subordinate of a subnet (for example, subnet 110) for the first time.
[0038] Detection of a new mount terminal of the processor 320 with which the control section 303 of a base station 140-1 is equipped requires the identification address which can be given to the new mount terminal of the gateway 130 (S801). (step S800)
[0039] The processor 220 with which the control section 203 of the gateway 130 is equipped will acquire an empty identification address (for example, AA.AA.AA.AA) with reference to the operating condition 401 of the identification address managed table 222, if a demand is received (S802). Next, a processor 220 notifies the acquired identification address to a base station 140-1 (S803).
[0040] "AA.AA.AA.AA" will be set as the identification address 600 of routing table 322, and the processor 320 with which the control section 303 of a base station 140-1 is equipped will set "**" as the existence 602 of "a terminal interface 300-2" and a base station subordinate in an output destination change 601, respectively, if a notice is received (S804, drawing 6).
[0041] Moreover, the processor 220 with which the control section 203 of the gateway 130 is equipped sets "under use" as the operating condition 401 of "AA.AA.AA.AA", and sets "a subnet 210" as the affiliation subnet 402, respectively. Furthermore, a processor 220 sets "AA.AA.AA.AA" as the identification address 500 of routing table 223, and sets "the base station interface 200-2" as an output destination change 501 (S805, drawing 4 R> 4, drawing 5). Next, a processor 220 generates the packet 211 containing the terminal detection message 212 (drawing 7), and transmits to a base station 140-2 - addressing to 140-n (S806).
[0042] "AA.AA.AA.AA" will be set as the identification address 600 of routing table 322, and the processor 320 with which the control section 303 of a base station 140-2 - 240-n is equipped will set "nothing" as the existence 602 of "a terminal interface 300-2" and a base station subordinate in an output destination change 601, if a notice is received (S807, drawing abbreviation).
[0043] Moreover, the processor 220 with which the control section 203 of the gateway 130 is equipped transmits the above-mentioned packet 211 also to the gateway 131 and addressing to 132 (S808). This packet 211 is transmitted to the gateways 131 and 132 through the gateway connection network 121.
[0044] The processor 220 with which the control section 203 of the gateways 131 and 132 is equipped searches the identification address 400 of the identification address managed table 222 based on the detection terminal identification address "AA.AA.AA.AA" (drawing 7) included in the terminal detection message 212. When there is an identification address "AA.AA.AA.AA" which is in agreement with an identification address 700, a processor 220 sets "under use" as an operating condition 401. Moreover, a processor 220 sets "a subnet 110" as the affiliation subnet 502 based on the message-sending former subnet name "a subnet 110" included in the terminal detection message 212 (S809, drawing 4). In addition, when the corresponding identification address does not exist, a processor 220 newly creates an entry after the entry of the identification address which can be given. Based on the terminal detection message 212, "AA.AA.AA.AA" is set as an identification address 400 and, as for it, a processor 220 sets "a subnet 110" as an operating condition 401 "during use" at the affiliation subnet 402.
[0045] Furthermore, the processor 220 with which the control section 203 of the gateway 130 is equipped notifies an identification address "AA.AA.AA.AA" to the IP network 120 (S810). By the above actuation, the packet addressed to the above-mentioned mounted terminal from the IP

network 120 is transmitted to a mounted terminal through the gateway 130 and a base station 140-1.
[0046] Drawing 9 is the flow Fig. showing communication system actuation when a mounted terminal moves between the base stations in the same subnet (for example, subnet 110).
[0047] For example, when the mounted terminal 104 (identification address "AA.AA.AA.AA") moves to wireless zone 101-[of base station 140-n] n from the wireless zone 101-1 of a base station 140-1, the terminal interface 300-2 with which base station 140-n is equipped detects the mounted terminal 104 (S900). Next, the processor 320 with which the control section 303 of base station 140-n is equipped analyzes the message 212 which received, and detects an identification address "AA.AA.AA.AA" (S901). Next, a processor 320 carries out the multiple address transfer of the packet 211 containing the terminal detection message 212 (drawing 7) which made "the subnet 110" "AA.AA.AA.AA" and a message-sending former subnet name for the identification address at the gateway 130, a base station 140-1 - 140- (n-1) (S902, S903). Moreover, a processor 320 rewrites the existence 602 of the base station subordinate of routing table 322 from "nothing" to "**" (S904, drawing 11 R> 1).
[0048] Next, the processor 320 with which the control section 303 of a base station 140-1 - 140- (n-1) is equipped analyzes the terminal detection message 212 which received. A processor 320 searches the identification address 600 of routing table 322 based on the detection terminal identification address "AA.AA.AA.AA" included in the terminal detection message 212. When a processor 320 has an identification address "AA.AA.AA.AA" and the existence 602 of a base station subordinate serves as "**", "nothing" is set as the existence 602 of a base station subordinate (S905). Here, the existence 602 of the base station subordinate of the routing table 322 with which a base station 140-1 is equipped writes and replaces "nothing" from "**" (drawing 11).
[0049] Moreover, the processor 220 with which the control section 203 of the gateway 130 is equipped analyzes the terminal detection message 212 which received. A processor 220 checks that the message-sending former subnet name 701 contained in the terminal detection message 212 is "a subnet 110", and discards the terminal detection message 212 (S906). By the above actuation, the packet from the IP network 120 comes (drawing 11) to be transmitted to the mounted terminal 104 of a migration place through base station 140-n.
[0050] Drawing 10 is the flow Fig. showing actuation of the communication system at the time of moving between the subnets from which a mounted terminal differs.
[0051] For example, when the mounted terminal 104 (identification address "AA.AA.AA.AA") moves to the wireless zone 141-1 of the base station 141-1 belonging to a subnet 111 from wireless zone 140-[of base station 140-n belonging to a subnet 110] n, the terminal interface 300-2 with which a base station 141-1 is equipped detects the mounted terminal 104 (1000). Next, the processor 320 with which the control section 303 of a base station 141-1 is equipped analyzes the message 212 which received, and detects an identification address "AA.AA.AA.AA" (S1001). Next, a processor 320 carries out the multiple address transfer of the packet 211 containing the terminal detection message 212 which made "the subnet 111" "AA.AA.AA.AA" and a message-sending former subnet name for the identification address at the gateway 131, a base station 141-2 - 141-n (S1002, S1003). Moreover, a processor 320 sets "AA.AA.AA.AA" as the identification address 600 of routing table 322, and sets "**" as "the base station interface 300-2" and the existence 602 of a base station subordinate in an output destination change 601 (S1004, drawing 12).
[0052] The processor 220 with which the control section 203 of the gateway 131 is equipped analyzes the terminal detection message 212 which received. A processor 220 rewrites the affiliation subnet 402 of the identification address managed table 222 from a subnet 110 to a subnet 111 based on the contents of the terminal detection message 212 (drawing 12). Moreover, although not illustrated, "AA.AA.AA.AA" is set as the identification address 500 of routing table 223, and "the base station interface 200-2" is set as an output destination change 501 (S1005).
[0053] The processor 320 with which the control section 303 of a base station 141-2 - 141-n is equipped analyzes the terminal detection message 212 which received. Although not illustrated,

based on the contents of the terminal detection message 212, "AA.AA.AA.AA" is set as the identification address 600 of routing table 322, and a processor 320 sets "nothing" as the existence 602 of "a terminal interface 300-2" and a base station subordinate in an output destination change 601 (S1006).

[0054] Next, the processor 220 with which the control section 203 of the gateway 131 is equipped carries out the multiple address transfer of the packet 211 containing the terminal detection message 212 which made "the subnet 111" "AA.AA.AA.AA" and a message-sending former subnet name for the identification address after processing of S1005 in the gateways 130 and 132 belonging to other subnets 110 and 112 (S1007).

[0055] Next, the processor 220 with which the control section 203 of the gateways 130 and 132 is equipped analyzes the terminal detection message 212 which received. A processor 220 rewrites the affiliation subnet 402 corresponding to "AA.AA.AA.AA" in the identification address 400 of the identification address managed table 222 from a subnet 110 to a subnet 111 based on the contents of the terminal detection message 212 (S1008, drawing 12). In addition, in the gateway 132, although not shown clearly, since a moved material subnet is a subnet 110, processing is ended. In routing table 223, as for the gateway 130 belonging to the moved material subnet 110, an identification address 500 deletes the area of "AA.AA.AA.AA." Next, the processor 220 with which the control section 203 of the gateway 130 is equipped carries out the multiple address transfer of the terminal detection message 212 which received at a base station 140-1 - 140-n (1009).

[0056] Although not illustrated, as for the processor 320 with which the control section 303 of a base station 140-1 - 140-n is equipped, an identification address 500 deletes the area of "AA.AA.AA.AA" (S1010, drawing 12). Furthermore, the processor 220 with which the control section 203 of the gateway 131 is equipped notifies an identification address "AA.AA.AA.AA" after processing of S1007 (S1011). By the above actuation, the packet from the IP network 120 comes (drawing 11) to be transmitted to the mounted terminal 104 of a migration place through a base station 141-1.

[0057] Drawing 12 is the flow Fig. showing actuation when the expiration date 403 of an identification address carries out a time-out (the value of an expiration date 403 is zero).

[0058] For example, the processor 220 with which the control section 203 of the gateway 130 is equipped executes an ICMP echo command towards the terminal in which the affiliation subnet 402 of the identification address managed table 222 has this identification address when an expiration date 403 carries out a time-out about the entry of "the gateway 130" (1300). A processor 220 judges the existence of the response from a terminal (1301). If there is a response from a terminal, a processor 220 will reset an expiration date 403 to a certain fixed value (1302), and will notify the renewal of an expiration date 403 to the gateways 131 and 232 belonging to other subnets 111 and 112 (1303). The processor 220 with which the control section 203 of the gateways 131 and 232 which received the notice is equipped resets the expiration date 403 of the corresponding identification address to a certain fixed value (1310). The processor 220 with which the control section 203 of the gateway 130 will be equipped if a terminal to a response cannot be found judges whether it is the identification address which self gave from the entry location of the identification address managed table 322 (1304). If it is the identification address which self gave, the processor 220 with which the control section 203 of the gateway 130 is equipped will set the operating condition 401 of the identification address managed table 222 as an opening (1305). Moreover, with the identification address which self gave, if there is nothing, the processor 220 with which the control section 203 of the gateway 130 is equipped will delete the entry of this identification address of the identification address managed table 322 (1306). Then, the processor 220 with which the control section 203 of the gateway 130 is equipped deletes an element with this identification address from routing table 223 (1307). Furthermore, the processor 220 with which the control section 203 of the gateway 130 is equipped makes the open identification address contained in the identification address disconnection informative message 212 the identification address of the terminal which did not answer, and it sends out to the base station 140-1 in the same subnet 110 - 140-n, and the gateways 131 and 232 belonging to other subnets 111 and 112 by the multiple address (1308).

The processor 320 with which the control section 303 of the base station 140-1 - 140-n which received the identification address disconnection informative message 212 is equipped deletes an element with the identification address shown in the open identification address contained in the identification address disconnection informative message 212 from routing table 322 (1309). The processor 220 with which the control section 203 of the gateways 131 and 132 which received the identification address disconnection informative message 212 is equipped About the identification address shown in an open identification address, from the entry location of the identification address managed table 222 If it is the identification address which judged whether it was the identification address which the gateway 130 gave, and the gateway 130 gave The operating condition 401 of the identification address managed table 222 is set as an opening, and if it is not the identification address which the gateway 130 gave, the entry of this identification address of the identification address managed table 222 will be deleted (1310). The entry about the terminal which moved out of the network by the above actuation is deleted.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the configuration of the whole communication system of this invention.
[Drawing 2] The block diagram showing the configuration of the gateway of this invention.
[Drawing 3] The block diagram showing the configuration of the base station of this invention.
[Drawing 4] Drawing showing the configuration of the identification address managed table of this invention.
[Drawing 5] Drawing showing the configuration of the routing table of this invention.
[Drawing 6] Drawing showing the configuration of the routing table of this invention similarly.
[Drawing 7] Drawing showing an example of a description.
[Drawing 8] The flow Fig. showing actuation of the communication system of this invention.
[Drawing 9] The flow Fig. showing actuation of the communication system of this invention similarly.
[Drawing 10] The flow Fig. showing actuation of the communication system of this invention similarly.
[Drawing 11] An output Fig. when a mounted terminal moves between base stations.
[Drawing 12] An output Fig. when a mounted terminal moves between subnets.
[Drawing 13] The flow Fig. showing actuation when the expiration date of an identification address carries out a time-out.
[Description of Notations]
100 [-- IP network, 121 / -- A gateway connection network, 130-132 / -- The gateway, 140-1 - 140-n, 141-1 - 141-n, 142-1 - 142-n / -- Base station.] -- A vehicle, 104 -- A mounted terminal, 110-112 -- A subnet, 120

[Translation done.]

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(54)【発明の名称】　通信システム

(57)【要約】
【課題】短時間で、かつネットワークの使用効率を低下させること無く、ハンドオーバーの実現を可能とする通信システムを提供する。
【解決手段】基地局１４１－ｎは、基地局１４０－ｎの無線ゾーン１０１－ｎから移動してきた端末１０４およびその識別アドレスを検出すると、予め登録されている経路情報を書き換え、端末を検出した旨をゲートウェイ１３１に通知し、ゲートウェイ１３１は、予め登録されている端末情報および経路情報を書き換え、端末を検出した旨をゲートウェイ１３０とゲートウェイ１３２に通知する。

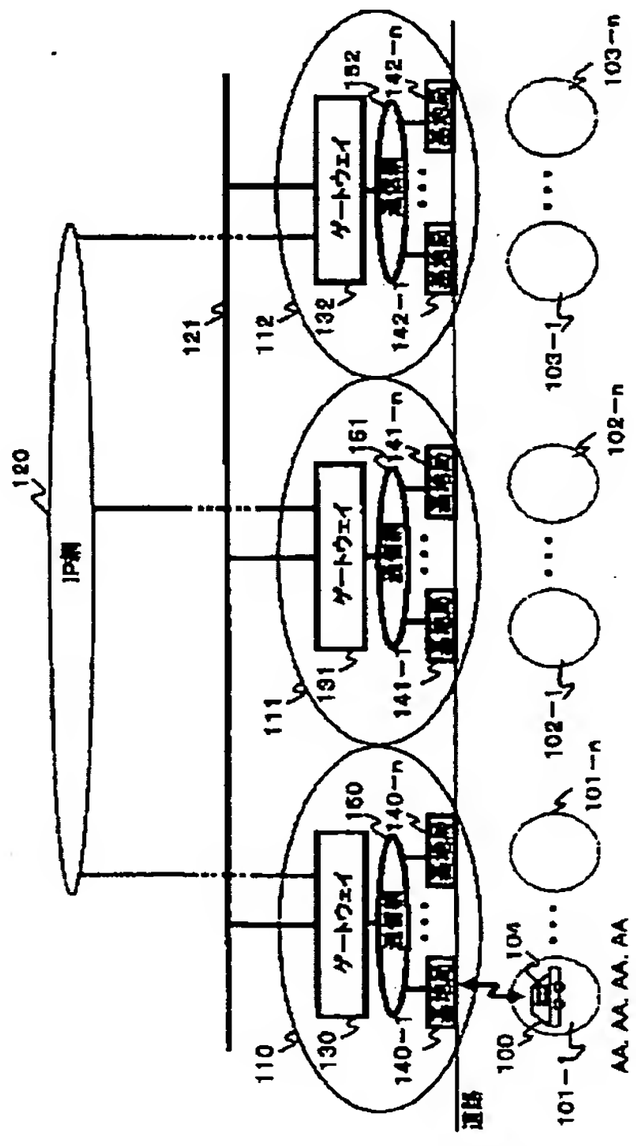

図1

【特許請求の範囲】
【請求項１】複数の網から構成され、前記複数の網のそれぞれは複数の無線装置と前記複数の無線装置と接続された通信装置とから構成される通信システムであって、前記複数の網のうち第１の網における何れかの基地局は、第２の網からの端末を検出すると、予め登録された経路情報を書き換える手段と、前記端末の検出情報を前記第１の網における通信装置宛に送信する手段とを有し、
前記第１の網における前記通信装置は、前記端末の検出情報に基づき予め登録された経路情報を書き換える手段と、前記端末の検出情報を前記第１の網以外の網における通信装置のそれぞれに送信する手段を有することを特徴とする通信システム。
【請求項２】前記端末の検出情報を受信した前記第１の網以外の網における通信装置のそれぞれは、前記端末の検出情報に基づき予め登録された経路情報を書き換えることを特徴とする請求項１記載の通信システム。
【請求項３】前記第１の網における第１の無線装置は、前記第１の網における第２の無線装置の無線エリアからの端末を検出すると、予め登録されている経路情報を書き換える手段と、前記第１の網における前記第１の無線装置以外の無線装置に前記端末の検出情報を送信する手段とを有し、
前記第１の無線装置以外の前記無線装置のそれぞれは、前記端末の検出情報を受信すると、予め登録されている経路情報を書き換える手段を有することを特徴とする請求項１記載の通信システム。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、高度道路交通システム(ITS；Intelligent Transport Systems)を実現する路車間通信システムに関する。
【０００２】
【従来の技術】近年、安全性の向上、輸送効率の向上、快適性の向上を目指したサービスを実現するため、道路と車両を一体のシステムとした高度道路交通システムの開発が進められている。
【０００３】その高度道路交通システムの一分野として、例えば、社団法人　電波産業会にて定められた標準規格「有料道路自動料金収受システム標準規格ARIBSTD－T551.2版」（平成１１年１２月１４日1.2改定）に記載の自動料金収受システム（ETC：Electric Toll Collection System）が知られている。自動料金収受システムは、有料道路の料金所において、料金所を通過する車両が停止することなく、車両に搭載された車載端末（車載装置）と、料金所に設置された路側装置との間で狭域通信（ＤＳＲＣ：Dedicated Short Range Communication）と呼ばれる無線通信を行って、通行料金を自動収受する路車間システムである。
【０００４】一方で、近年のインターネットの爆発的な普及に伴い、高度道路交通システムにＩＰ（Internet Protocol）通信技術を適用して、音声、データ、画像等、様々な通信サービス（ＩＰパケット通信）を実現したいとの要望がある。この場合には、車両に搭載された端末が移動しても通信の継続を可能とする技術（ハンドオーバー）が必要となる。
【０００５】ハンドオーバーを実現する技術としては、例えば、「RFC（Request For Comment：インターネットに関する情報を伝える文書）2002」に規定のモバイル（Mobile）ＩＰ技術がある。本技術は、主に端末を本来使用している場所から一時的に移動して使用する場合を想定して開発されている。端末が普段所属しているネットワーク（ホームネットワーク：Home Network）にホームエージェント（ＨＡ：Home Agent）と呼ばれるノードを介在させる。又、移動先のネットワーク（フォーリンネットワーク：Foreign Network）にフォーリンエージェント（ＦＡ：Foreign Agent）と呼ばれるノードを介在させる。端末がホームネットワークからフォーリンネットワークに移動した場合におけるパケットの転送は、一旦ホームエージェントに送信した後、フォーリンエージャント宛に転送され、端末に送信される。
【０００６】
【発明が解決しようとする課題】上述の狭域通信は、マイクロ波帯の電波を使用しているため、無線通信可能な範囲（無線ゾーン）が３０ｍと小さく、かつ無線ゾーン同士の重なり範囲も無い。従って、車両が、このような複数の無線ゾーンを高速に移動しても途切れることなく継続してＩＰ通信を可能とするためには、短時間でハンドオーバーを実現する必要がある。又、上記モバイルＩＰ技術は、ＩＰネットワークからのパケットが一旦ホームエージェントに集中する。従って、非常に多くの車両が高速に移動する路車間システムにモバイルＩＰ技術を適用した場合、ホームエージェントの処理能力の低下、ひいてはネットワークの使用効率の低下を招くことになる。
【０００７】以上の点に鑑みて、本発明の目的は、短時間でハンドオーバーを実現することの出来る通信システムを提供することにある。
【０００８】本発明の他の目的は、ネットワークの使用効率を低下させること無く、ハンドオーバーを実現することの出来る通信システムを提供することにある。
【０００９】
【課題を解決するための手段】上記課題を解決するために、本発明の通信システムは、複数のサブネットから構成され、前記複数のサブネットのそれぞれは複数の基地局と前記複数の基地局と接続されたゲートウェイとから構成される通信システムであって、前記複数のサブネットのうち第１のサブネットにおける何れかの基地局は、第２のサブネットからの端末を検出すると、予め登録さ

れた経路情報を書き換える手段と、前記端末の検出情報を前記第１のサブネットにおけるゲートウェイ宛に送信する手段とを有し、前記第１のサブネットにおける前記ゲートウェイは、前記端末の検出情報に基づき予め登録された経路情報を書き換える手段と、前記端末の検出情報を前記第１のサブネット以外のサブネットにおけるゲートウェイのそれぞれに送信する手段を有する。前記端末の検出情報を受信した前記第１のサブネット以外のサブネットにおけるゲートウェイのそれぞれは、前記端末の検出情報に基づき予め登録された経路情報を書き換える手段を有する。

【００１０】又、前記第１のサブネットにおける第１の基地局は、前記第１のサブネットにおける第２の基地局の無線エリアからの端末を検出すると、予め登録された経路情報を書き換える手段と、前記第１のサブネットにおける前記第１の基地局以外の基地局に前記端末の検出情報を送信する手段とを有し、前記第１の基地局以外の前記基地局のそれぞれは、前記端末の検出情報を受信すると、予め登録された経路情報を書き換える手段を有する。

【００１１】

【発明の実施の形態】以下、本発明による通信システムの実施形態について、図面を参照して詳細に説明する。

【００１２】図１は、本発明の通信システム全体の構成を示す図である。

【００１３】本発明の通信システムは、路車間システムにおいてＩＰ通信を可能とすべく、ネットワーク１１０（以下、サブネット１１０と称する）と、サブネット１１１と、サブネット１１２と、ＩＰ網（例えば、モバイルＩＰ網）１２０とから構成されている。サブネット１１０は、道路の路側に設置された複数の基地局（無線装置）１４０－１～１４０－ｎと、基地局１４０－１～１４０－ｎと接続された通信網１５０と、通信網１５０と接続されたゲートウェイ（通信装置）１３０とから構成されている。なお、図中、１０１－１～１０１－ｎは、それぞれ基地局１４０－１～１４０－ｎの無線ゾーンを示していいる。又、車１００に搭載された車載端末１０４には、車載端末１０４を識別するための識別アドレス（例えば、AA.AA.AA.AA）が付与されている。サブネット１１１、サブネット１１２もサブネット１１０と同様の構成となっている。

【００１４】又、本発明では、ゲートウェイ１３０～１３２は、ＩＰ網２２０と接続されている。更に、本発明では、ゲートウェイ１３０～１３２は、それぞれゲートウェイ間接続網２２１により相互接続されている。又、本発明では、ゲートウェイ１３０～１３２のそれぞれは、配下にある各基地局の宛先情報を管理している。ゲートウェイ１３０～１３２は、ＩＰ網２２０からのパケットを、それぞれ配下の各基地局宛に同報転送する。

【００１５】詳細を後述するが、本発明による基地局１４０－１～１４０－ｎは、それぞれ配下における車載端末の経路情報を管理している。同一のサブネット内において、車載端末が基地局間を移動した場合、移動先基地局は端末およびその端末の識別アドレスを検出して、予め登録された車載端末の経路情報の内容を書き換える。又、移動先基地局は、同一サブネット内に属する他の基地局宛に、車載端末を検出した旨を通知する。端末検出通知を受けた他の基地局は、その内容に基づき車載端末の経路情報の内容を書き換える。以上の動作により、ＩＰ網１２０からのパケットが、移動先の車載端末に送信される。

【００１６】又、ゲートウェイ１３０～１３２のそれぞれは、サブネットに属する車載端末の情報（例えば、識別アドレス）および経路情報を管理している。車載端末がサブネット間を移動した場合、移動先サブネットに属する基地局は、上記同様にして予め登録された経路情報を書き換える。又、上記基地局は、同一サブネット内のゲートウェイおよび他の基地局に車載端末の識別アドレスを通知する。通知を受けたゲートウェイは、端末情報および経路情報の内容を書き換え、車載端末を検出した旨を他のサブネットに属するゲートウェイに通知する。又、通知を受けた基地局は経路情報の内容を書き換える。他のサブネットに属するゲートウェイ、基地局も同様にして予め登録されている上記情報の内容を書き換える。以上の動作により、ＩＰ網１２０からのパケットが、移動先の車載端末に送信される。

【００１７】図２は、本発明のゲートウェイ１３０の構成を示すブロック図である。ゲートウェイ１３１、ゲートウェイ１３２もゲートウェイ１３０と同様の構成となっている。

【００１８】ゲートウェイ１３０は、ＩＰ網インタフェース２００－１と、基地局インタフェース２００－２と、ゲートウェイ間接続網インタフェース２００－３と、ルーティング部２０１と、メッセージ処理部２０２と、制御部２０３とから構成されている。更に、制御部２０３は、プロセッサ２２０と、プログラム格納メモリ２２１と、識別アドレス管理テーブル２２２と、ルーティングテーブル２２３とを備え、ゲートウェイ１３０全体を統括的に制御する。

【００１９】ここで、ゲートウェイ間接続網インタフェース２００－３は、ゲートウェイ１３１又はゲートウェイ１３２から受信したパケット２１１をルーティング部２０１に送信する。上記パケット２１１には、識別アドレス管理テーブル２２２の内容（端末情報）およびルーティングテーブル２２３の内容（経路情報）を書き換えるための端末検出情報等のメッセージが含まれている。ルーティング部２０１は、ゲートウェイ間接続網インタフェース２００－３から受信したパケット２１１をメッセージ処理部２０２に送信する。メッセージ処理部２０２は、ルーティング部２０１から受信したパケット２１

１をメッセージ２１２に組み立てて制御部２０３に送信する。制御部２０３に備えるプロセッサ２２０は、メッセージの内容を解析して、識別アドレス管理テーブル２２２とルーティングテーブル２２３の内容を書き換える。

【００２０】又、上記メッセージ処理部２０２は、制御部２０３から受信したメッセージ２１２をパケット２１１に組み立ててルーティング部２０１に送信する。ルーティング部２０１は、メッセージ処理部２０２から受信したパケット２１１をゲートウェイ間接続網インタフェース２００－３に送信する。ゲートウェイ間接続網インタフェース２００－３は、ルーティング部２０１から受信したパケット２１１をゲートウェイ接続網１２１に送信する。

【００２１】次に、ＩＰ網２２０から受信したパケット２１０は、ＩＰ網インタフェース２００－１を介してルーティング部２０１に送信される。ルーティング部２０１は、ルーティングテーブル２２３に基づき、ＩＰ網インタフェース２００－１から受信したパケット２１０を基地局インタフェース２００－２に交換（スイッチング）する。基地局インタフェース２００－２は、ルーティング部２０１から受信したパケット２１０を基地局１４０－１～１４０－ｎ宛に同報転送する。同様に、基地局１４０－１～１４０－ｎからのパケットは、基地局インタフェース２００－２、ルーティング部２０１、ＩＰ網インタフェース２００－１を介してＩＰ網２２０に送信される。

【００２２】なお、上述した基地局インタフェース２００－１は、基地局毎に設けても良い。又、上述したメッセージ処理部２０２の処理は、制御部２０３で行うようにしても良い。

【００２３】図３は、本発明の基地局１４０－１の構成を示すブロック図である。基地局１４０－２～２４－ｎも基地局１４０－１と同様の構成となっている。

【００２４】基地局１４０－１は、ゲートウェイ、基地局インタフェース３００－１と、端末インタフェース３００－２と、ルーティング部３０１と、メッセージ処理部３０２と、制御部３０３とから構成されている。更に、制御部３０３は、プロセッサ３２０と、プログラム格納メモリ３２１と、ルーティングテーブル３２２とを備え、基地局１４０－１全体を統括的に制御する。

【００２５】なお、ルーティング部３０１、メッセージ処理部３０２、制御部３０３の各部における動作は、図２に示すルーティング部２０１、メッセージ処理部２０２、制御部２０３と同様であるので、ここでは詳細な説明は省略する。

【００２６】メッセージを含むパケット２１１は、ゲートウェイ、基地局インタフェース３００－１、ルーティング部３０１、メッセージ処理部３０２を介して制御部３０３に送信される。同様に、制御部３０３からのメッセージを含むパケットは、メッセージ処理部３０２、ルーティング部３０１を介してゲートウェイ、基地局インタフェース３００－１に送信される。

【００２７】又、ＩＰ網２２０からのパケット２１０は、ゲートウェイ、基地局インタフェース３００－１、ルーティング部３０１を介して端末インタフェース３００－２に送信される。端末インタフェース３００－２は、ルーティング部３０１から受信したパケット２１０を車載端末に送信する。同様に、車載端末からのパケット２１０は、端末インタフェース３００－２、ルーティング部３０１を介してゲートウェイ、基地局インタフェース３００－１に送信される。

【００２８】図４は、本発明のゲートウェイに備える識別アドレス管理テーブル３２２の構成を示す図である。

【００２９】識別アドレス管理テーブル２２２には、識別アドレス４００と、使用状況４０１と、所属サブネット４０２と、有効期限４０３の各エリアから構成されている。識別アドレス４００には、使用中の識別アドレス、もしくは車載端末に付与可能な識別アドレスが格納されている。使用状況４０１には、識別アドレス４００のエリアに格納されている各識別アドレスが車載端末に使用されているか否かを表す情報が格納されている。所属サブネット４０２には、識別アドレスが車載端末に使用されている場合、その車載端末の所属するサブネット名が格納されている。有効期限４０３には、車載端末に使用されている識別アドレスの有効期限が格納されている。

【００３０】図５は、本発明のゲートウェイに備えるルーティングテーブル２２３の構成を示す図である。

【００３１】ルーティングテーブル２２３には、車載端末の識別アドレス５００と、パケットの出力先を示す出力先５０１の各エリアから構成されている。

【００３２】図６は本発明の基地局に備えるルーティングテーブル３２２の構成を示す図である。

【００３３】ルーティングテーブル３２２には、識別アドレス６００と、パケットの出力先を示す出力先６０１と、基地局配下の存在６０２の各エリアから構成されている。基地局配下の存在６０２には、識別アドレス６００に格納されている各識別アドレスを有する車載端末がその基地局の配下に存在するか否かを表す情報が格納されている。

【００３４】図７は、本発明のメッセージ内容の一例を示す図である。

【００３５】図７に示す例では、車載端末が同一サブネット内における基地局、もしくはサブネット間を移動した場合に使用する端末検出メッセージ２１２を示している。端末検出メッセージ２１２は、検出された車載端末の識別アドレスを格納する検出端末識別アドレス７００と、車載端末が検出されたサブネット名を格納するメッセージ送信元サブネット名７０１の各エリアから構成さ

れている。
【００３６】なお、後述するが、識別アドレスを有する車載端末が、通信システム（図１）外に離脱した場合に使用するメッセージを識別アドレス開放通知メッセージ２１２と称する。その車載端末の識別アドレスが開放すべき識別アドレスとしてメッセージ２１２に含まれている。開放された識別アドレスは、他の車載端末に付与可能となる。
【００３７】図８は、車載端末が初めてサブネット（例えば、サブネット１１０）の配下に入った場合における通信システムの動作を示すフロー図である。
【００３８】基地局１４０－１の制御部３０３に備えるプロセッサ３２０が新規車載端末を検出すると（ステップＳ８００）、ゲートウェイ１３０にその新規車載端末に付与可能な識別アドレスを要求する（Ｓ８０１）。
【００３９】ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は要求を受けると、識別アドレス管理テーブル２２２の使用状況４０１を参照して、空きの識別アドレス（例えば、AA.AA.AA.AA）を取得する（Ｓ８０２）。次にプロセッサ２２０は、取得した識別アドレスを基地局１４０－１に通知する（Ｓ８０３）。
【００４０】基地局１４０－１の制御部３０３に備えるプロセッサ３２０は通知を受けると、ルーティングテーブル３２２の識別アドレス６００に“AA.AA.AA.AA”、出力先６０１に“端末インタフェース３００－２”、基地局配下の存在６０２に“有”をそれぞれ設定する（Ｓ８０４、図６）。
【００４１】又、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、“AA.AA.AA.AA”の使用状況４０１に“使用中”、所属サブネット４０２に“サブネット２１０”をそれぞれ設定する。更に、プロセッサ２２０は、ルーティングテーブル２２３の識別アドレス５００に“AA.AA.AA.AA”、出力先５０１に“基地局インタフェース２００－２”を設定する（Ｓ８０５、図４、図５）。次に、プロセッサ２２０は、端末検出メッセージ２１２（図７）を含むパケット２１１を生成して、基地局１４０－２～１４０－ｎ宛に送信する（Ｓ８０６）。
【００４２】基地局１４０－２～２４０－ｎの制御部３０３に備えるプロセッサ３２０は通知を受けると、ルーティングテーブル３２２の識別アドレス６００に“AA.AA.AA.AA”、出力先６０１に“端末インタフェース３００－２”、基地局配下の存在６０２に“無”を設定する（Ｓ８０７、図省略）。
【００４３】又、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、上記パケット２１１をゲートウェイ１３１、１３２宛にも送信する（Ｓ８０８）。このパケット２１１は、ゲートウェイ間接続網１２１を介してゲートウェイ１３１、１３２に送信される。
【００４４】ゲートウェイ１３１、１３２の制御部２０３に備えるプロセッサ２２０は、端末検出メッセージ２１２に含まれる検出端末識別アドレス“AA.AA.AA.AA”（図７）に基づき、識別アドレス管理テーブル２２２の識別アドレス４００を検索する。識別アドレス７００に一致する識別アドレス“AA.AA.AA.AA”が有る場合、プロセッサ２２０は、使用状況４０１に“使用中”を設定する。又、プロセッサ２２０は、端末検出メッセージ２１２に含まれるメッセージ送信元サブネット名“サブネット１１０”に基づき、所属サブネット５０２に“サブネット１１０”を設定する（Ｓ８０９、図４）。なお、該当する識別アドレスが存在しない場合、プロセッサ２２０は、付与可能な識別アドレスのエントリ以降に新たにエントリを作成する。プロセッサ２２０は、端末検出メッセージ２１２に基づき、識別アドレス４００に“AA.AA.AA.AA”、使用状況４０１に“使用中”、所属サブネット４０２に“サブネット１１０”を設定する。
【００４５】更に、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、ＩＰ網１２０に識別アドレス“AA.AA.AA.AA”を通知する（Ｓ８１０）。以上の動作により、ＩＰ網１２０からの上記車載端末宛のパケットは、ゲートウェイ１３０、基地局１４０－１を介して車載端末に送信される。
【００４６】図９は、車載端末が同一サブネット（例えば、サブネット１１０）内の基地局間を移動した場合における通信システム動作を示すフロー図である。
【００４７】例えば、車載端末１０４（識別アドレス“AA.AA.AA.AA”）が、基地局１４０－１の無線ゾーン１０１－１から基地局１４０－ｎの無線ゾーン１０１－ｎに移動した場合、基地局１４０－ｎに備える端末インタフェース３００－２は、車載端末１０４を検出する（Ｓ９００）。次に、基地局１４０－ｎの制御部３０３に備えるプロセッサ３２０は、受信したメッセージ２１２を解析して識別アドレス“AA.AA.AA.AA”を検出する（Ｓ９０１）。次に、プロセッサ３２０は、識別アドレスを“AA.AA.AA.AA”、メッセージ送信元サブネット名を“サブネット１１０”とした端末検出メッセージ２１２（図７）を含むパケット２１１を、ゲートウェイ１３０と基地局１４０－１～１４０－（ｎ－１）に同報転送する（Ｓ９０２、Ｓ９０３）。又、プロセッサ３２０は、ルーティングテーブル３２２の基地局配下の存在６０２を“無”から“有”に書き換える（Ｓ９０４、図１１）。
【００４８】次に、基地局１４０－１～１４０－（ｎ－１）の制御部３０３に備えるプロセッサ３２０は、受信した端末検出メッセージ２１２を解析する。プロセッサ３２０は、端末検出メッセージ２１２に含まれる検出端末識別アドレス“AA.AA.AA.AA”に基づき、ルーティングテーブル３２２の識別アドレス６００を検索する。プロセッサ３２０は、識別アドレス“AA.AA.AA.AA”が有り、かつ基地局配下の存在６０２が“有”となっている

場合、基地局配下の存在６０２に“無”を設定する（Ｓ９０５）。ここでは、基地局１４０－１に備えるルーティングテーブル３２２の基地局配下の存在６０２が“有”から“無”に書き換わる（図１１）。

【００４９】又、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、受信した端末検出メッセージ２１２を解析する。プロセッサ２２０は、その端末検出メッセージ２１２に含まれるメッセージ送信元サブネット名７０１が“サブネット１１０”であることを確認し、その端末検出メッセージ２１２を廃棄する（Ｓ９０６）。以上の動作により、ＩＰ網１２０からのパケットは、基地局１４０－ｎを介して移動先の車載端末１０４に送信されるようになる（図１１）。

【００５０】図１０は、車載端末が異なるサブネット間を移動した場合における通信システムの動作を示すフロー図である。

【００５１】例えば、車載端末１０４（識別アドレス“AA.AA.AA.AA”）が、サブネット１１０に属する基地局１４０－ｎの無線ゾーン１４０－ｎからサブネット１１１に属する基地局１４１－１の無線ゾーン１４１－１に移動した場合、基地局１４１－１に備える端末インタフェース３００－２は、車載端末１０４を検出する（１０００）。次に、基地局１４１－１の制御部３０３に備えるプロセッサ３２０は、受信したメッセージ２１２を解析して識別アドレス“AA.AA.AA.AA”を検出する（Ｓ１００１）。次に、プロセッサ３２０は、識別アドレスを“AA.AA.AA.AA”、メッセージ送信元サブネット名を“サブネット１１１”とした端末検出メッセージ２１２を含むパケット２１１を、ゲートウェイ１３１と基地局１４１－２～１４１－ｎに同報転送する（Ｓ１００２、Ｓ１００３）。又、プロセッサ３２０は、ルーティングテーブル３２２の識別アドレス６００に“AA.AA.AA.AA”、出力先６０１に“基地局インタフェース３００－２”、基地局配下の存在６０２に“有”を設定する（Ｓ１００４、図１２）。

【００５２】ゲートウェイ１３１の制御部２０３に備えるプロセッサ２２０は、受信した端末検出メッセージ２１２を解析する。プロセッサ２２０は、端末検出メッセージ２１２の内容に基づき、識別アドレス管理テーブル２２２の所属サブネット４０２をサブネット１１０からサブネット１１１に書き換える（図１２）。又、図示していないが、ルーティングテーブル２２３の識別アドレス５００に“AA.AA.AA.AA”、出力先５０１に“基地局インタフェース２００－２”を設定する（Ｓ１００５）。

【００５３】基地局１４１－２～１４１－ｎの制御部３０３に備えるプロセッサ３２０は、受信した端末検出メッセージ２１２を解析する。図示していないが、プロセッサ３２０は、端末検出メッセージ２１２の内容に基づき、ルーティングテーブル３２２の識別アドレス６００に“AA.AA.AA.AA”、出力先６０１に“端末インタフェース３００－２”、基地局配下の存在６０２に“無”を設定する（Ｓ１００６）。

【００５４】次に、ゲートウェイ１３１の制御部２０３に備えるプロセッサ２２０は、Ｓ１００５の処理後、識別アドレスを“AA.AA.AA.AA”、メッセージ送信元サブネット名を“サブネット１１１”とした端末検出メッセージ２１２を含むパケット２１１を、他のサブネット１１０、１１２に属するゲートウェイ１３０、１３２に同報転送する（Ｓ１００７）。

【００５５】次に、ゲートウェイ１３０、１３２の制御部２０３に備えるプロセッサ２２０は、受信した端末検出メッセージ２１２を解析する。プロセッサ２２０は、端末検出メッセージ２１２の内容に基づき、識別アドレス管理テーブル２２２の識別アドレス４００が“AA.AA.AA.AA”に対応する所属サブネット４０２をサブネット１１０からサブネット１１１に書き換える（Ｓ１００８、図１２）。なお、明示していないが、ゲートウェイ１３２においては、移動元サブネットはサブネット１１０であるので、処理を終了する。移動元サブネット１１０に属するゲートウェイ１３０は、ルーティングテーブル２２３において、識別アドレス５００が“AA.AA.AA.AA”のエリアを削除する。次に、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、受信した端末検出メッセージ２１２を基地局１４０－１～１４０－ｎに同報転送する（１００９）。

【００５６】図示していないが、基地局１４０－１～１４０－ｎの制御部３０３に備えるプロセッサ３２０は、識別アドレス５００が“AA.AA.AA.AA”のエリアを削除する（Ｓ１０１０、図１２）。更に、ゲートウェイ１３１の制御部２０３に備えるプロセッサ２２０は、Ｓ１００７の処理後、識別アドレス“AA.AA.AA.AA”を通知する（Ｓ１０１１）。以上の動作により、ＩＰ網１２０からのパケットは、基地局１４１－１を介して移動先の車載端末１０４に送信されるようになる（図１１）。

【００５７】図１２は、識別アドレスの有効期限４０３がタイムアウトした時（有効期限４０３の値がゼロ）の動作を示すフロー図である。

【００５８】例えば、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、識別アドレス管理テーブル２２２の所属サブネット４０２が“ゲートウェイ１３０”のエントリについて、有効期限４０３がタイムアウトした時には該識別アドレスを持つ端末に向けてＩＣＭＰエコーコマンドを実行する（１３００）。プロセッサ２２０は、端末からの応答の有無を判定する（１３０１）。端末から応答があれば、プロセッサ２２０は、有効期限４０３をある一定の値に再設定し（１３０２）、他のサブネット１１１、１１２に属するゲートウェイ１３１、２３２に有効期限４０３の更新を通知する（１３０３）。通知を受けたゲートウェイ１３１、２３２の制

御部２０３に備えるプロセッサ２２０は、該当する識別アドレスの有効期限４０３をある一定の値に再設定する（１３１０）。端末から応答が無ければ、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、識別アドレス管理テーブル３２２のエントリ位置から、自己が付与した識別アドレスかどうかを判定する（１３０４）。自己が付与した識別アドレスならば、ゲートウェイ130の制御部２０３に備えるプロセッサ２２０は、識別アドレス管理テーブル２２２の使用状況４０１を空きに設定する（１３０５）。又、自己が付与した識別アドレスで無ければ、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、識別アドレス管理テーブル３２２の該識別アドレスのエントリを削除する（１３０６）。その後、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、ルーティングテーブル２２３から該識別アドレスを持つ要素を削除する（１３０７）。更に、ゲートウェイ１３０の制御部２０３に備えるプロセッサ２２０は、識別アドレス開放通知メッセージ２１２に含まれる開放識別アドレスを応答しなかった端末の識別アドレスとし、同一サブネット１１０内の基地局１４０－１～１４０－ｎと、他のサブネット１１１、１１２に属するゲートウェイ131、２３２に同報で送出する（１３０８）。識別アドレス開放通知メッセージ２１２を受信した基地局１４０－１～１４０－ｎの制御部３０３に備えるプロセッサ３２０は、ルーティングテーブル３２２から、識別アドレス開放通知メッセージ２１２に含まれる開放識別アドレスに示される識別アドレスを持つ要素を削除する（１３０９）。識別アドレス開放通知メッセージ２１２を受信したゲートウェイ１３１、１３２の制御部２０３に備えるプロセッサ２２０は、開放識別アドレスに示される識別アドレスについて、識別アドレス管理テーブル２２２のエントリ位置から、ゲートウェイ１３０が付与した識別アドレスかどうかを判定し、ゲートウェイ１３０が付与した識別アドレスならば、識別アドレス管理テーブル２２２の使用状況４０１を空きに設定し、ゲートウェイ１３０が付与した識別アドレスでなければ、識別アドレス管理テーブル２２２の該識別アドレスのエントリを削除する（１３１０）。以上の動作によりネットワーク外に移動した端末についてのエントリは削除される。

【００５９】

【発明の効果】本発明によると、短時間でハンドオーバーを実現することのできる通信システムを提供することが出来る。

【００６０】又、本発明によると、ネットワークの使用効率を低下させること無く、ハンドオーバーを実現することのできる通信システムを提供することが出来る。

【図面の簡単な説明】

【図１】本発明の通信システム全体の構成を示す図。

【図２】本発明のゲートウェイの構成を示すブロック図。

【図３】本発明の基地局の構成を示すブロック図。

【図４】本発明の識別アドレス管理テーブルの構成を示す図。

【図５】本発明のルーティングテーブルの構成を示す図。

【図６】同じく、本発明のルーティングテーブルの構成を示す図。

【図７】メッセージ内容の一例を示す図。

【図８】本発明の通信システムの動作を示すフロー図。

【図９】同じく、本発明の通信システムの動作を示すフロー図。

【図１０】同じく、本発明の通信システムの動作を示すフロー図。

【図１１】車載端末が基地局間を移動した場合の出力図。

【図１２】車載端末がサブネット間を移動した場合の出力図。

【図１３】識別アドレスの有効期限がタイムアウトした時の動作を示すフロー図。

【符号の説明】

１００…車、１０４…車載端末、１１０～１１２…サブネット、１２０…ＩＰ網、１２１…ゲートウェイ間接続網、１３０～１３２…ゲートウェイ、１４０－１～１４０－ｎ、１４１－１～１４１－ｎ、１４２－１～１４２－ｎ…基地局。

【図５】

図5

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500 識別アドレス	501 出力先
AA.AA.AA.AA	基地局インタフェース２００－２
・	・
・	・
・	・

【図６】

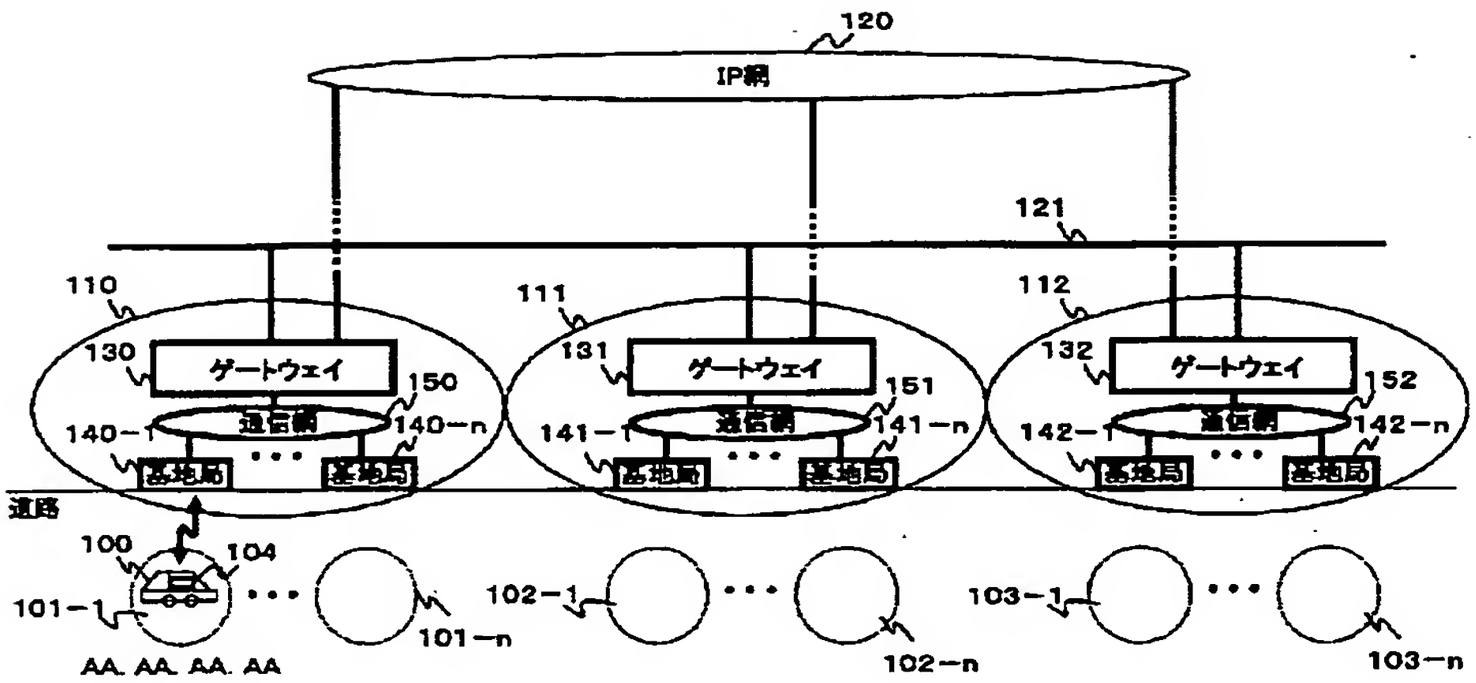
図6

322

600 識別アドレス	601 出力先	602 基地局配下の存在
AA.AA.AA.AA	端末インタフェース３００－２	有
・	・	・
・	・	・
・	・	・

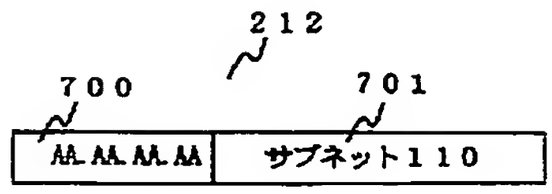
【図１】

図1



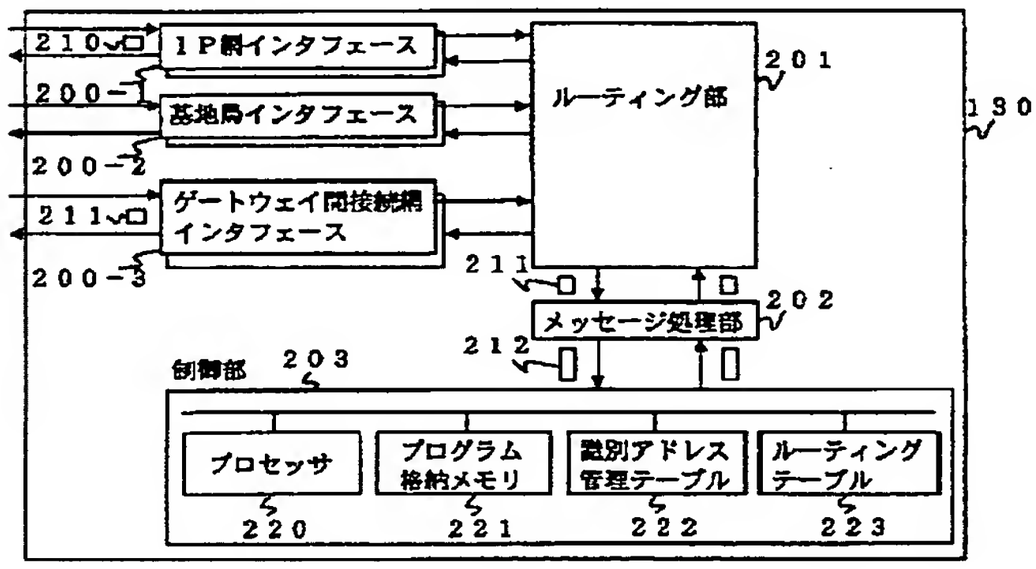
【図７】

図7



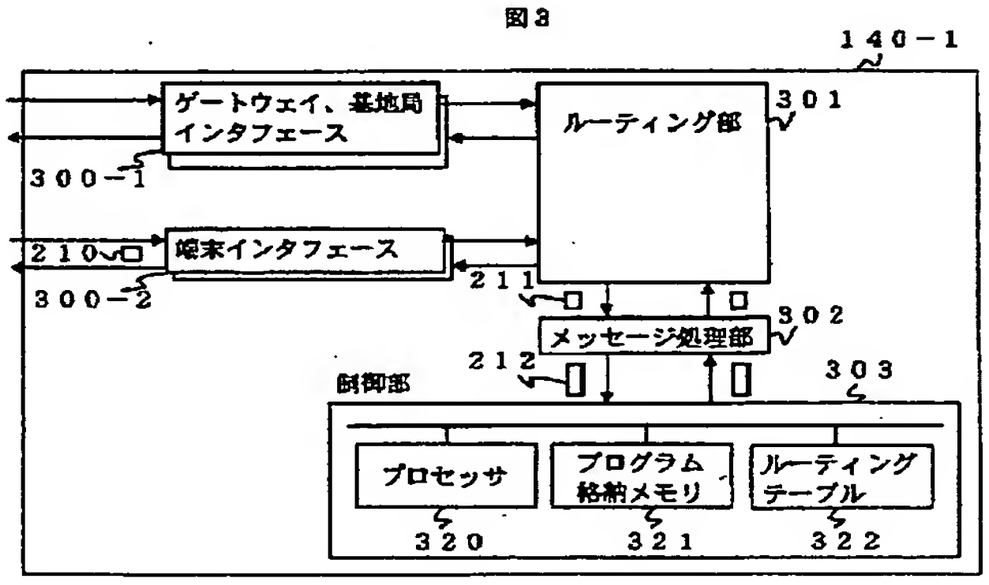
【図２】

図2



【図３】

図3



【図４】

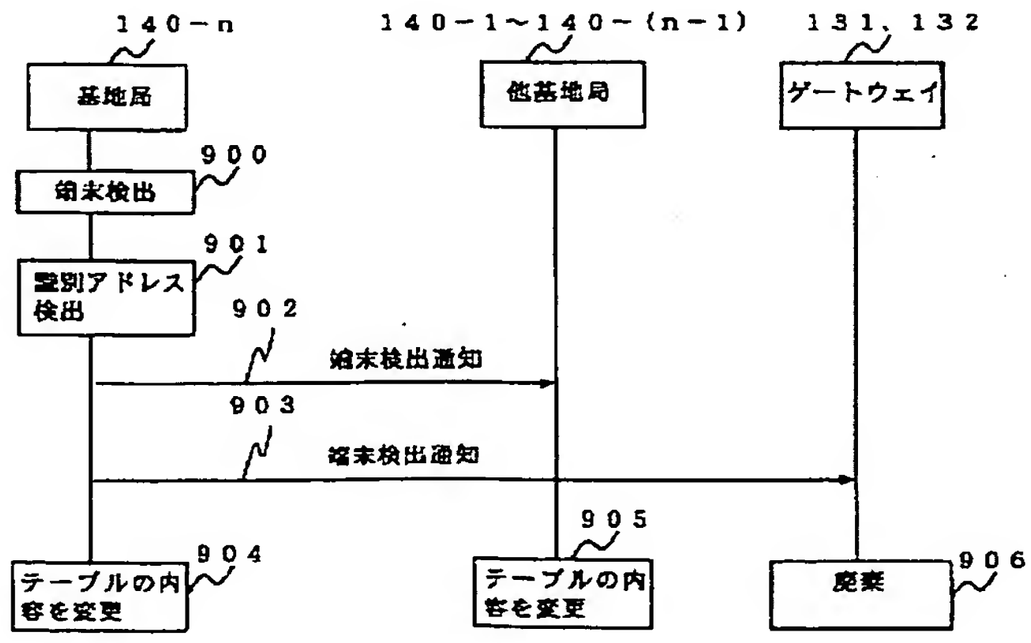
図4

222

400 識別アドレス	401 使用状況	402 所属サブネット	403 有効期限
AA.AA.AA.AA	使用中	サブネット２１０	cc
BB.BB.BB.BB	空き		
：	：	：	
ZZ.ZZ.ZZ.ZZ	空き		

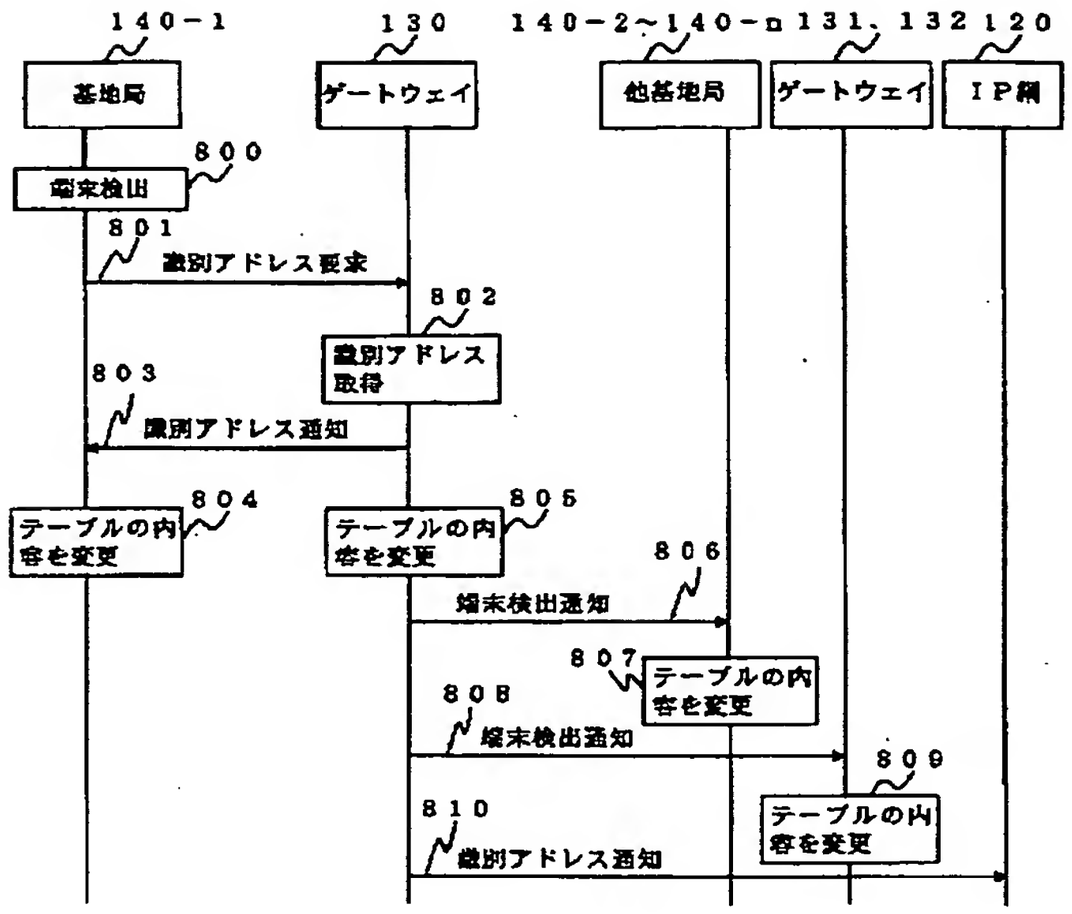
【図９】

図9



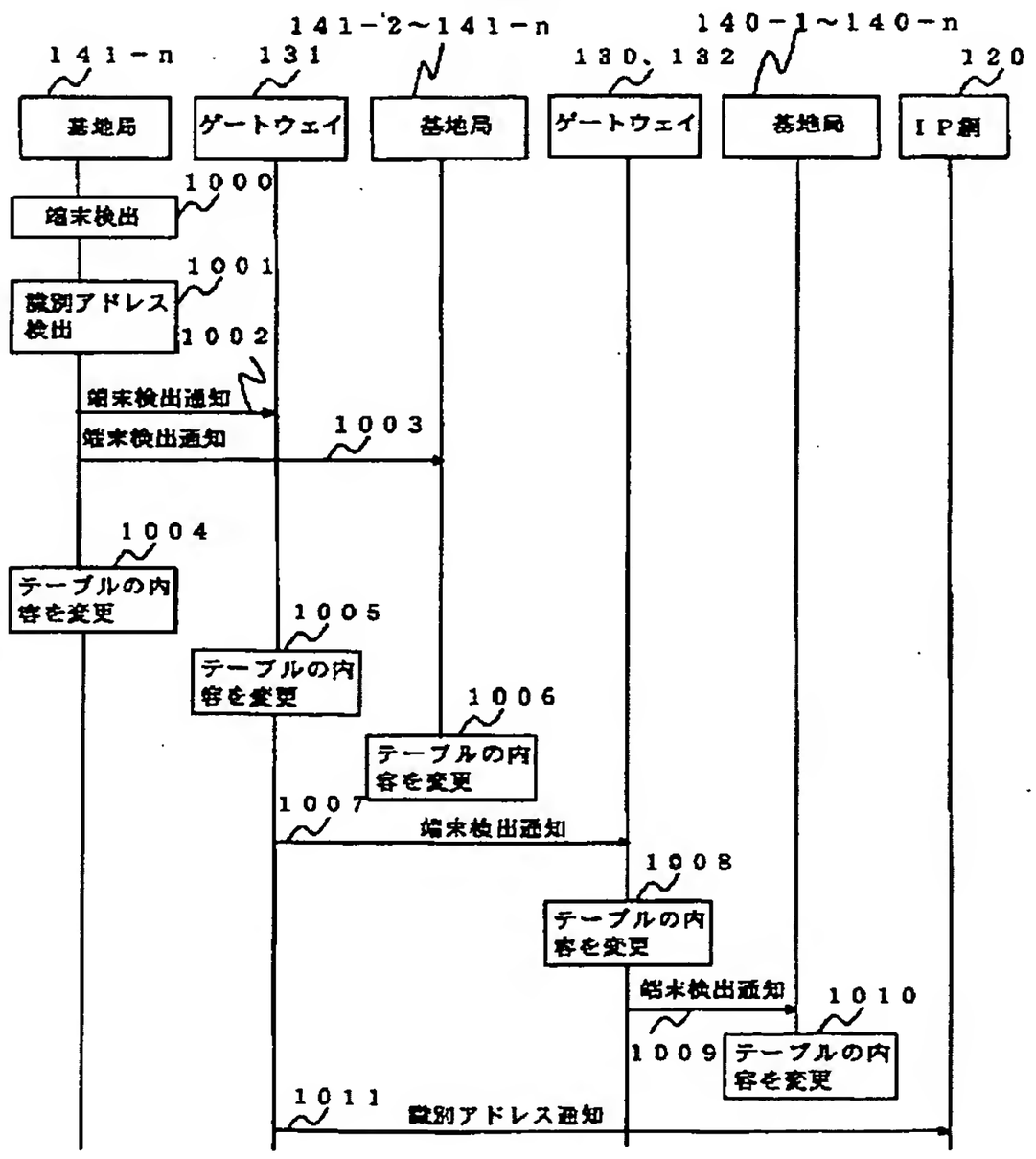
【図８】

図８


140－1
130
140－2～140－n
131、132
120
基地局
ゲートウェイ
他基地局
ゲートウェイ
ＩＰ網
800
電源検出
801
識別アドレス要求
802
識別アドレス取得
803
識別アドレス通知
804
テーブルの内容を変更
805
テーブルの内容を変更
806
端末検出通知
807
テーブルの内容を変更
808
端末検出通知
809
テーブルの内容を変更
810
識別アドレス通知

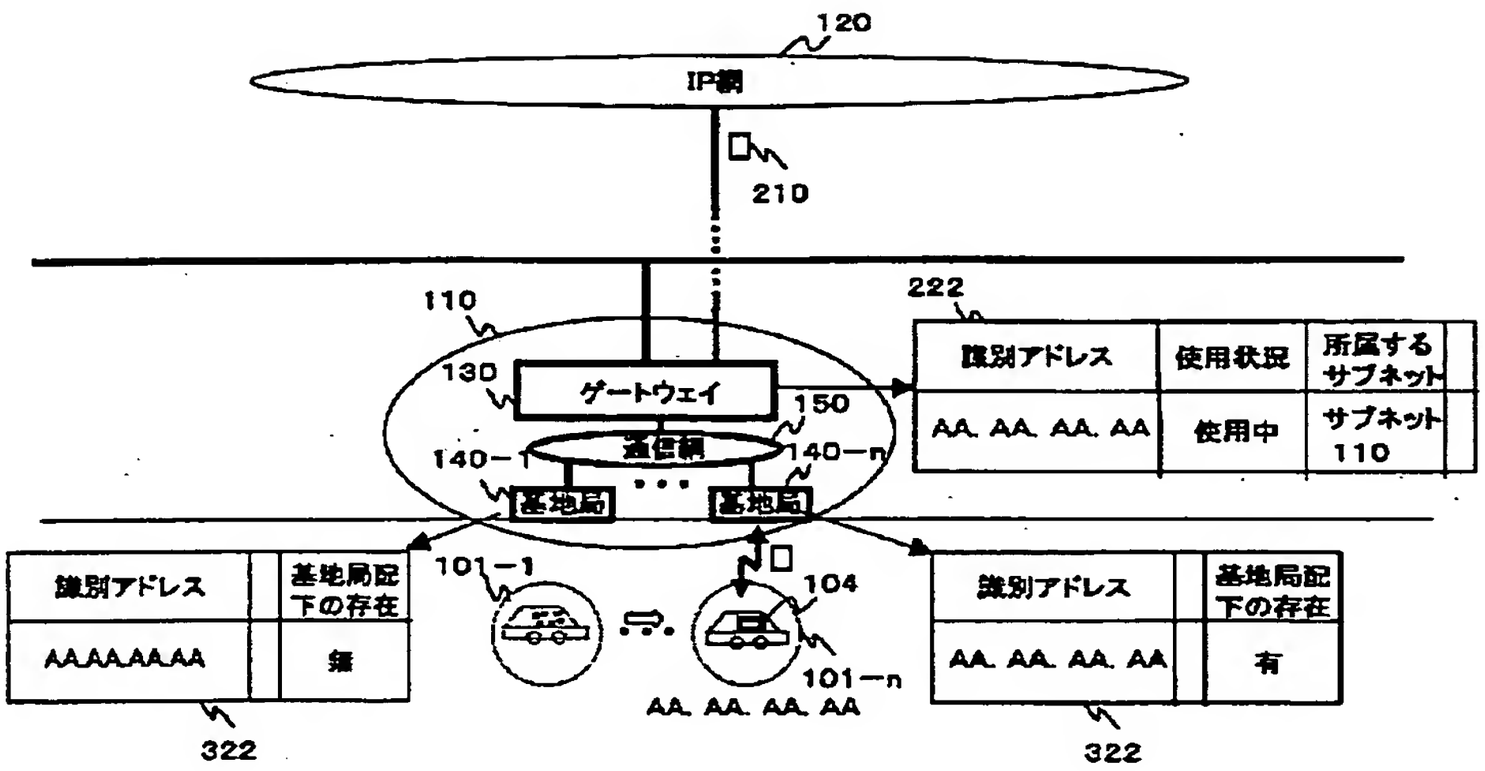
【図１０】

図１０


141－2～141－n
140－1～140－n
141－n
131
130、132
120
基地局
ゲートウェイ
基地局
ゲートウェイ
基地局
ＩＰ網
1000
端末検出
1001
識別アドレス検出
1002
端末検出通知
1003
端末検出通知
1004
テーブルの内容を変更
1005
テーブルの内容を変更
1006
テーブルの内容を変更
1007
端末検出通知
1008
テーブルの内容を変更
端末検出通知
1009
1010
テーブルの内容を変更
1011
識別アドレス通知

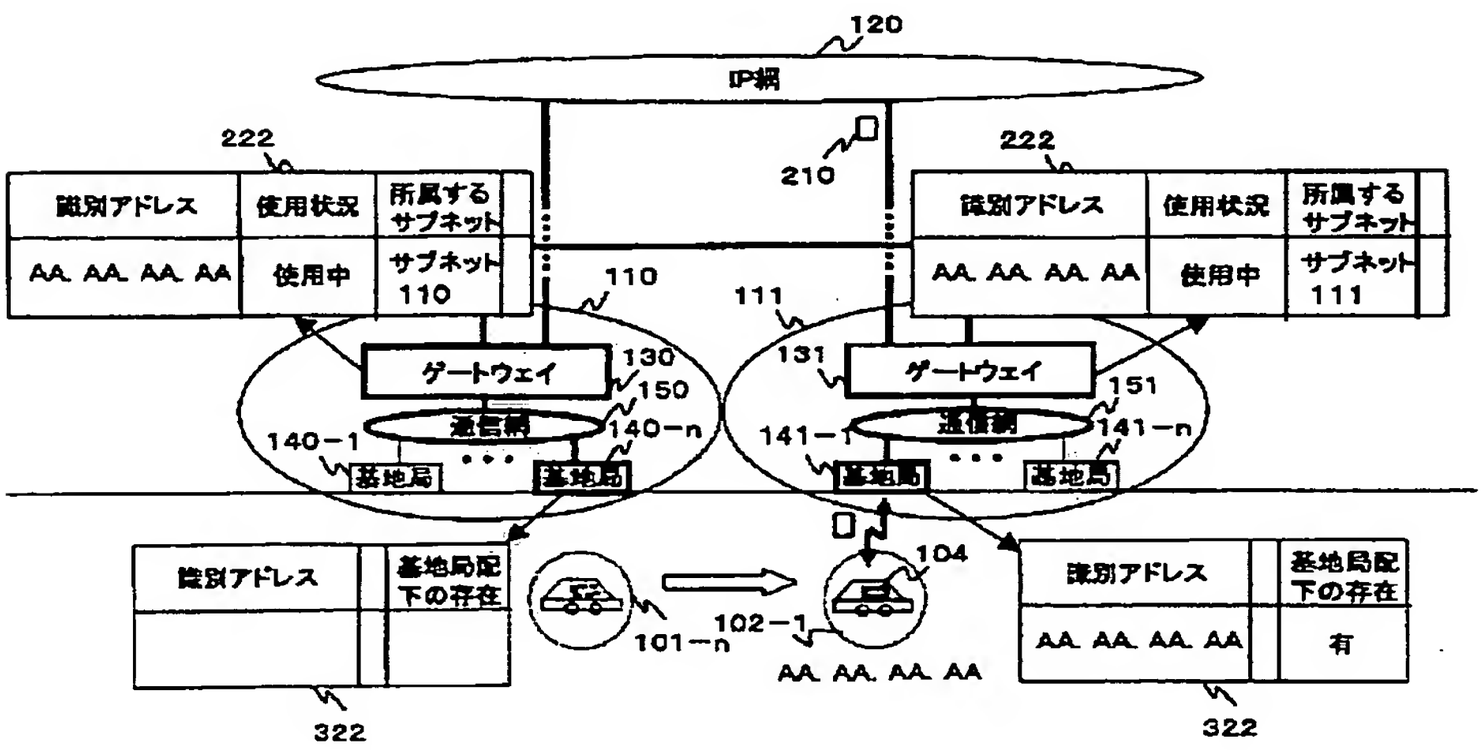
【図１１】

図11



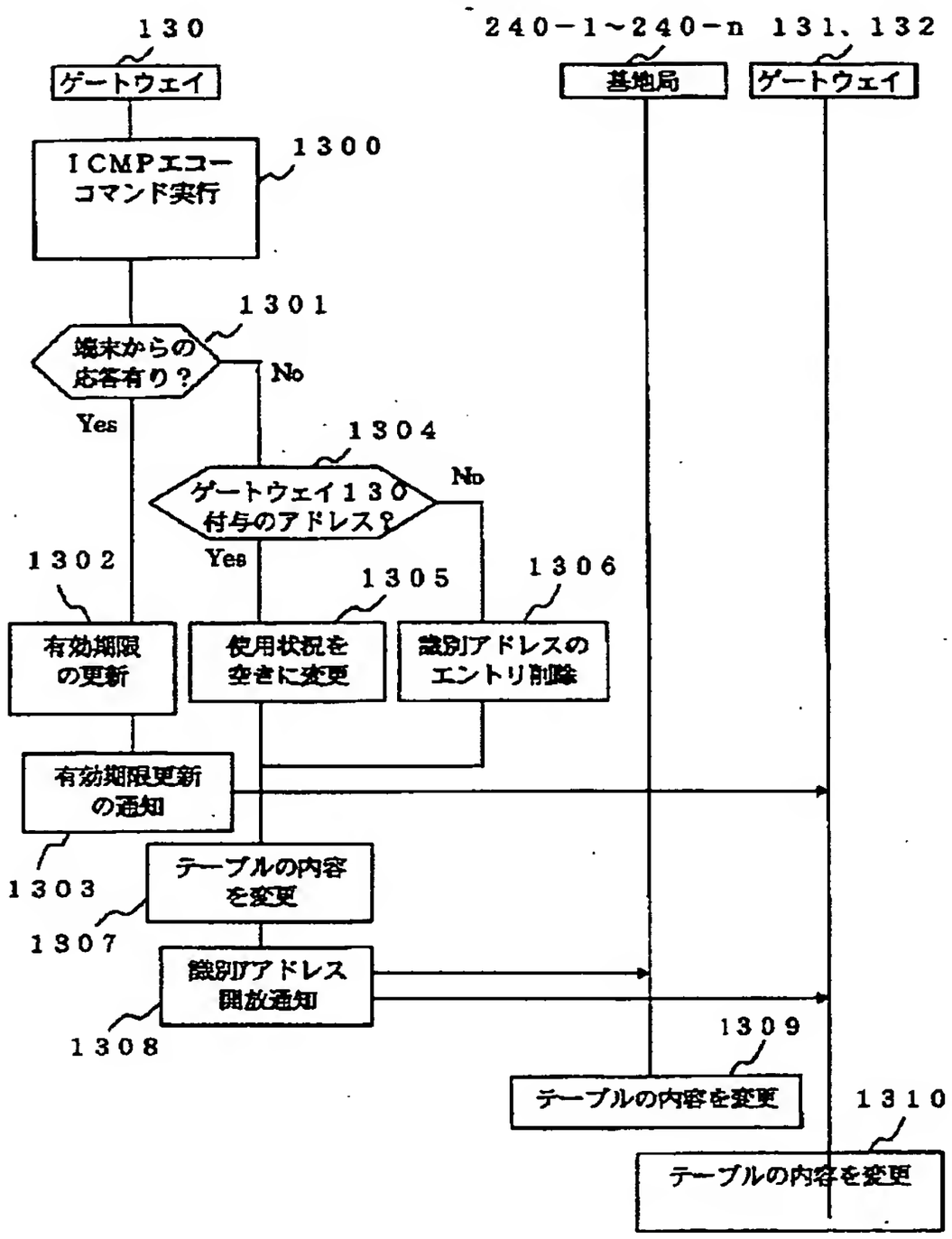
【図１２】

図12



【図１３】

図13



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Ｈ０４Ｑ	7/34				Ｆ
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